

# Viewer Movement in OpenGL

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## 1 Administrivia

### Announcements

New project handout.

### Assignment

Read 5.8–5.9.

### From Last Time

Linear algebra basis for computer graphics transformations.

### Outline

1. Understanding clipping volumes and their specifications.
2. Projections.
3. Movements in 3-D.
4. Toward a better movement model.

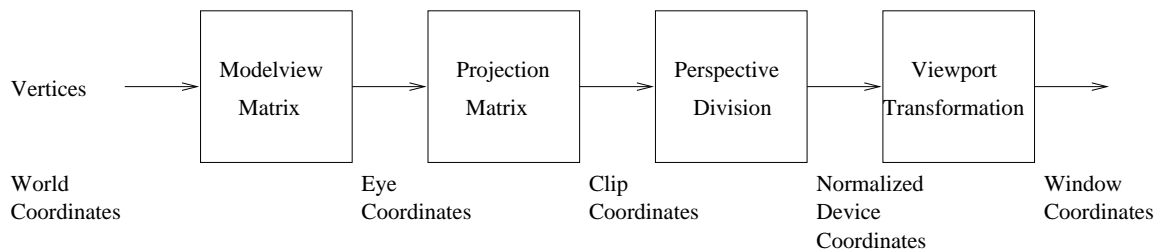
## Coming Up

Movement through a room.

## 2 Preliminary: Viewing Volumes

Are our viewing volume coordinates relative or absolute?

Consider:



1. By default, the eye is at  $(0, 0, 0)$  looking down the  $-z$  axis.
2. What does

```
glOrtho(-10.0, 10.0, -5.0, 5.0, -2.0, 2.0);
```

mean?

3. Other viewing modes:

- (a) `glFrustum`: same parameters as `glOrtho`. What's a frustum? Truncated pyramid.
- (b) `gluPerspective`: fovy, aspect ratio, zNear, and zFar.

znear and zfar need to be **positive**.

### 3 Moving and Positioning the Eye

*View* specification:

1. One way of specifying eye position and viewing angle:
  - (a) Specify position of eye.
  - (b) Specify center of field of view.
  - (c) Specify “up.”
2. Use of `gluLookAt()` in `cubeview.c`:

```
void display(void)
{
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

    /* Update viewer position in modelview matrix */

    glLoadIdentity();
    gluLookAt(viewer[0],viewer[1],viewer[2], 0.0, 0.0, 0.0,
              0.0, 1.0, 0.0);

    /* rotate cube */

    glRotatef(theta[0], 1.0, 0.0, 0.0);
    glRotatef(theta[1], 0.0, 1.0, 0.0);
    glRotatef(theta[2], 0.0, 0.0, 1.0);

    colorcube();

    glutSwapBuffers();
}
```

Note order of matrix multiplications: view, then model transformations.

3. Is it really necessary to have view and model transformations?

### 3.1 Example Runs

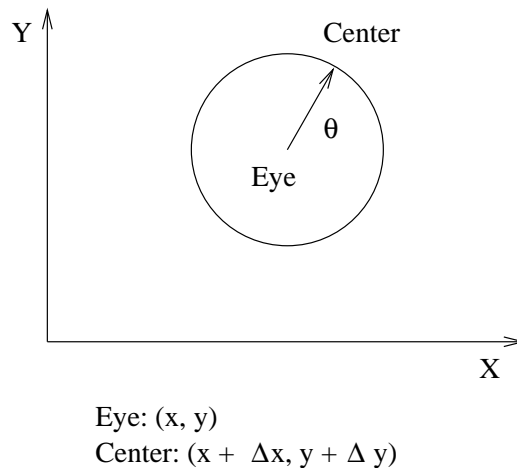
1. P1: Stock viewcube using frustum. Demonstrate clipping, invisibility when up vector is parallel to line of sight, walking through the cube.
2. P2: Perspective view with fovy 45, near 2, and far 20.
3. P3: Perspective view with fovy 135, near 0.1, far 100.

## 4 A Movement Model

Problems with viewer movement in cubeview:

1. Must specify movement in global coordinate values.
2. Can't speak of left, right, forward, backward, etc.

Consider this model:



1. What should the radius of the circle be?
2. Given  $x$ ,  $y$ , and  $\theta$ , what's  $\Delta x$  and  $\Delta y$ ?
3. How do we handle left, right, forward and backward?

4. Suppose, to see the “big picture,” I wanted to elevate on the  $Z$ -axis. What should I do with center? Is that easy to do?