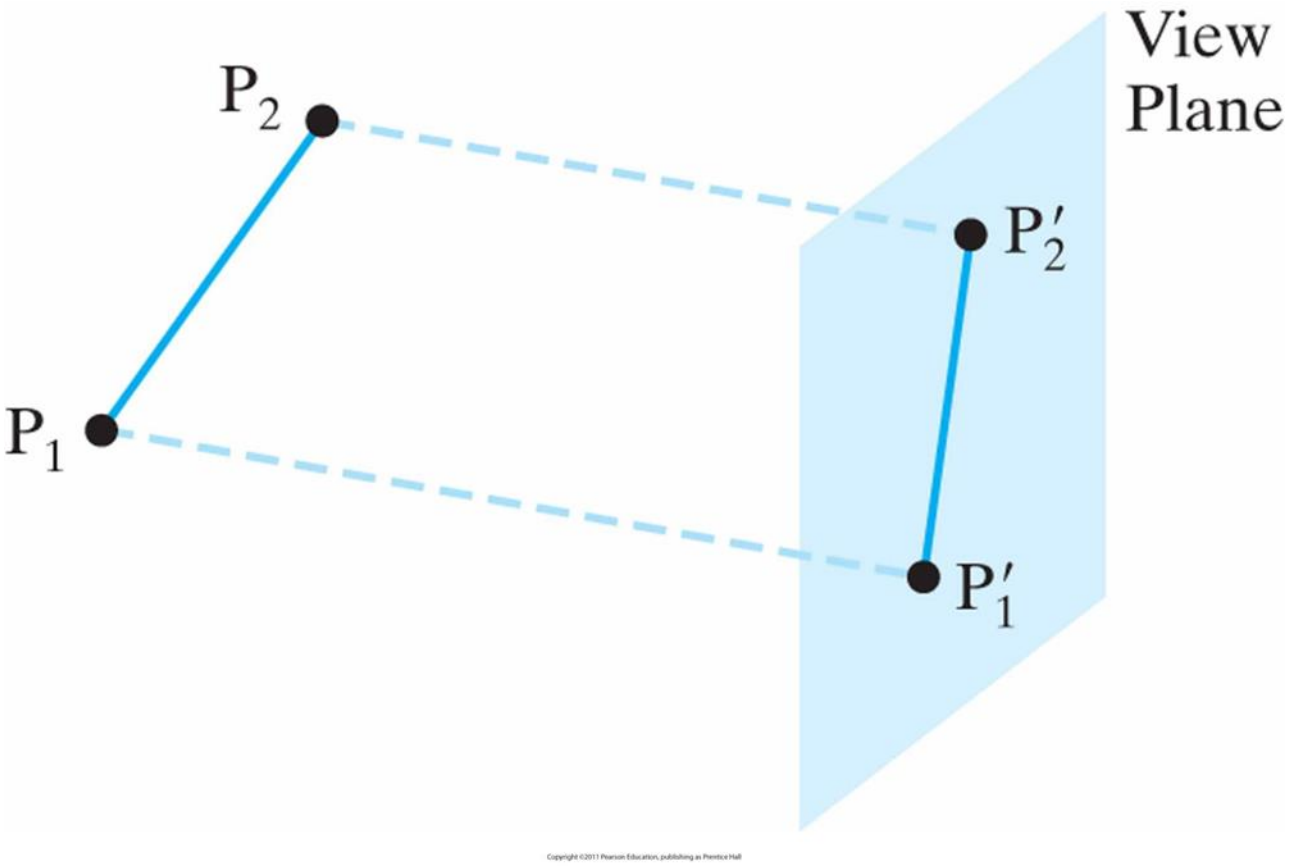
Projections

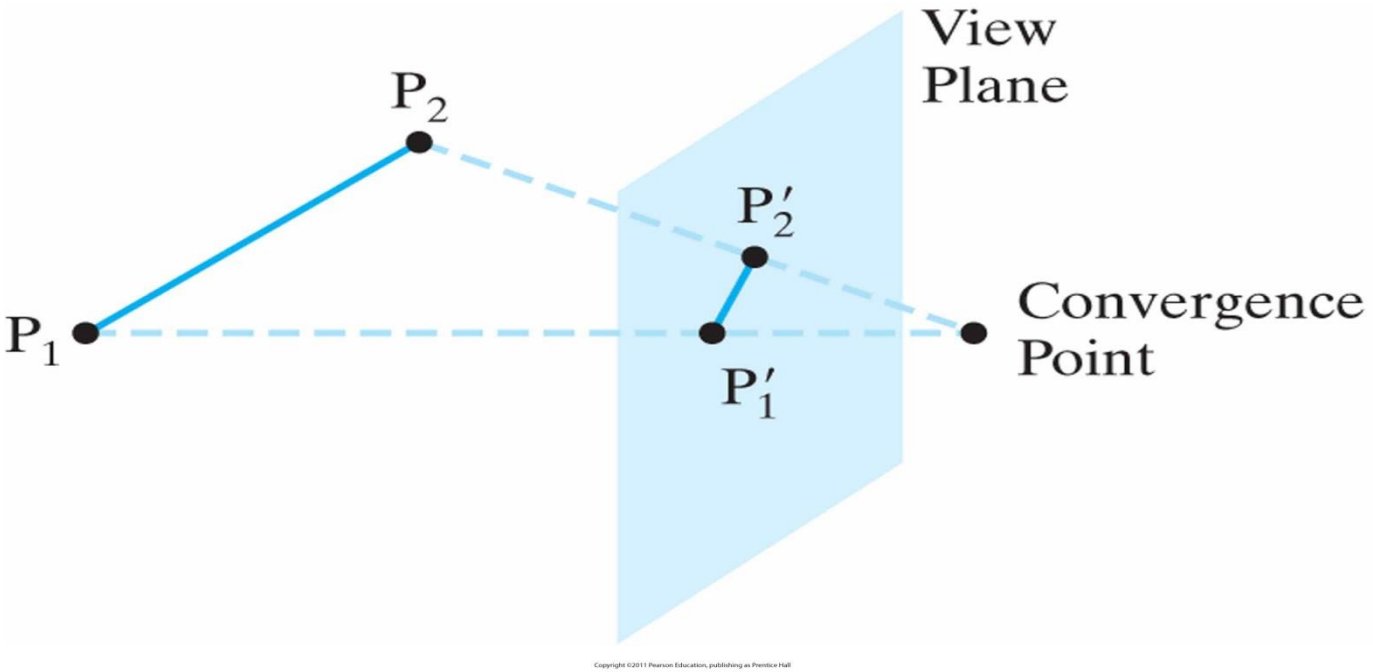
Projection Transformation

- Specifying the projection transformation is like choosing a lens for a camera
- You can think of this transformation as determining what the field of view or viewing volume is and therefore what objects are inside it
- This is equivalent to choosing among wide-angle, normal, and telephoto lenses, for example
  - With a wide-angle lens, you can include a wider scene in the final photograph than with a telephoto lens, but a telephoto lens allows you to photograph objects as though they're closer to you than they actually are

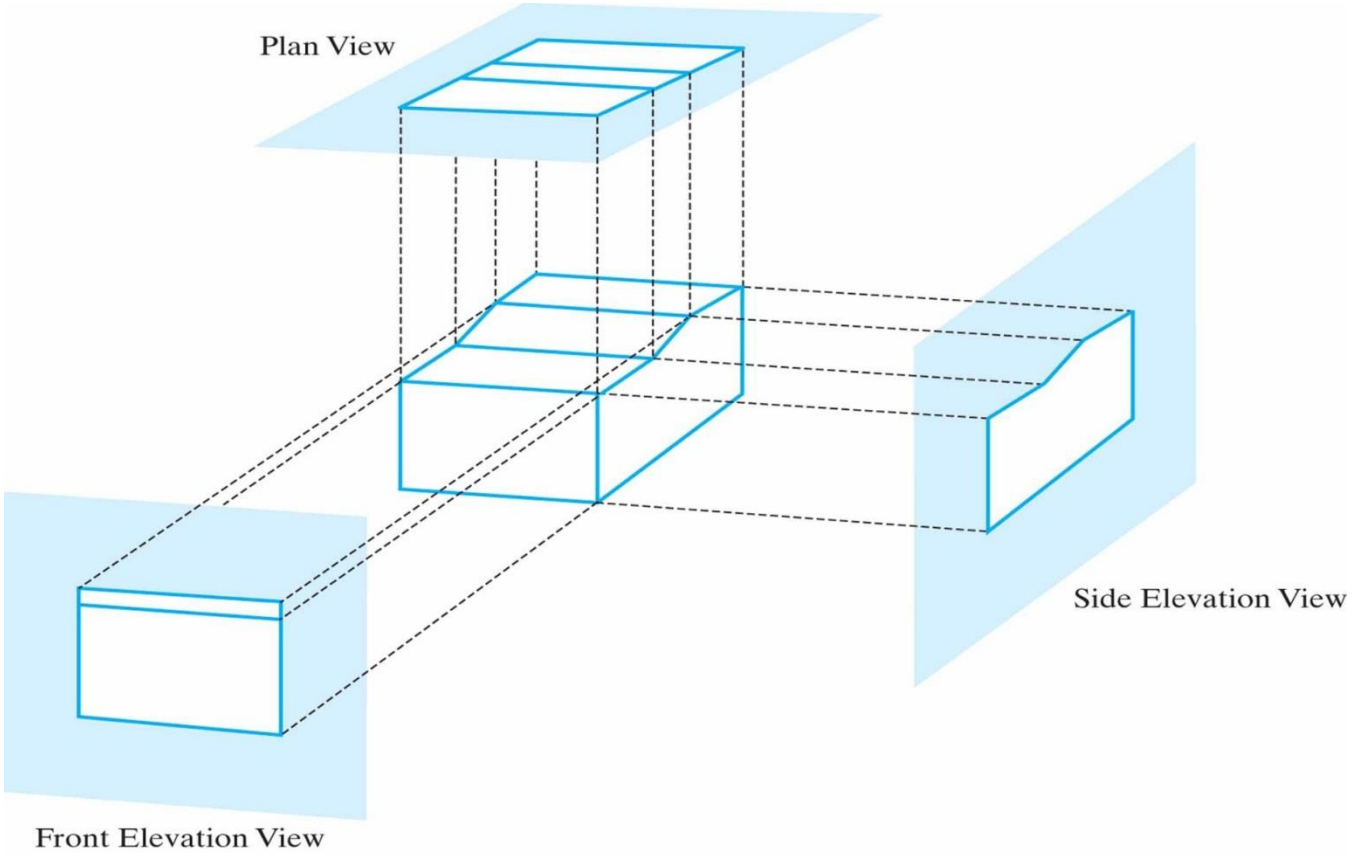
- Basic types of projections
  - **parallel projection**, where proportions are preserved



- Basic types of projections
  - **perspective projection**, which matches how you see things in daily life. Perspective makes objects that are farther away appear smaller; for example, it makes railroad tracks appear to converge in the distance



- Basic types of projections
  - **orthographic**, which maps objects directly onto the screen without affecting their relative size. Orthographic projection is used in architectural and computer-aided design applications where the final image needs to reflect the measurements of objects rather than how they might look
    - **Elevations:** Side, front, rear orthogonal projection
    - **Plan view:** Top orthogonal projection

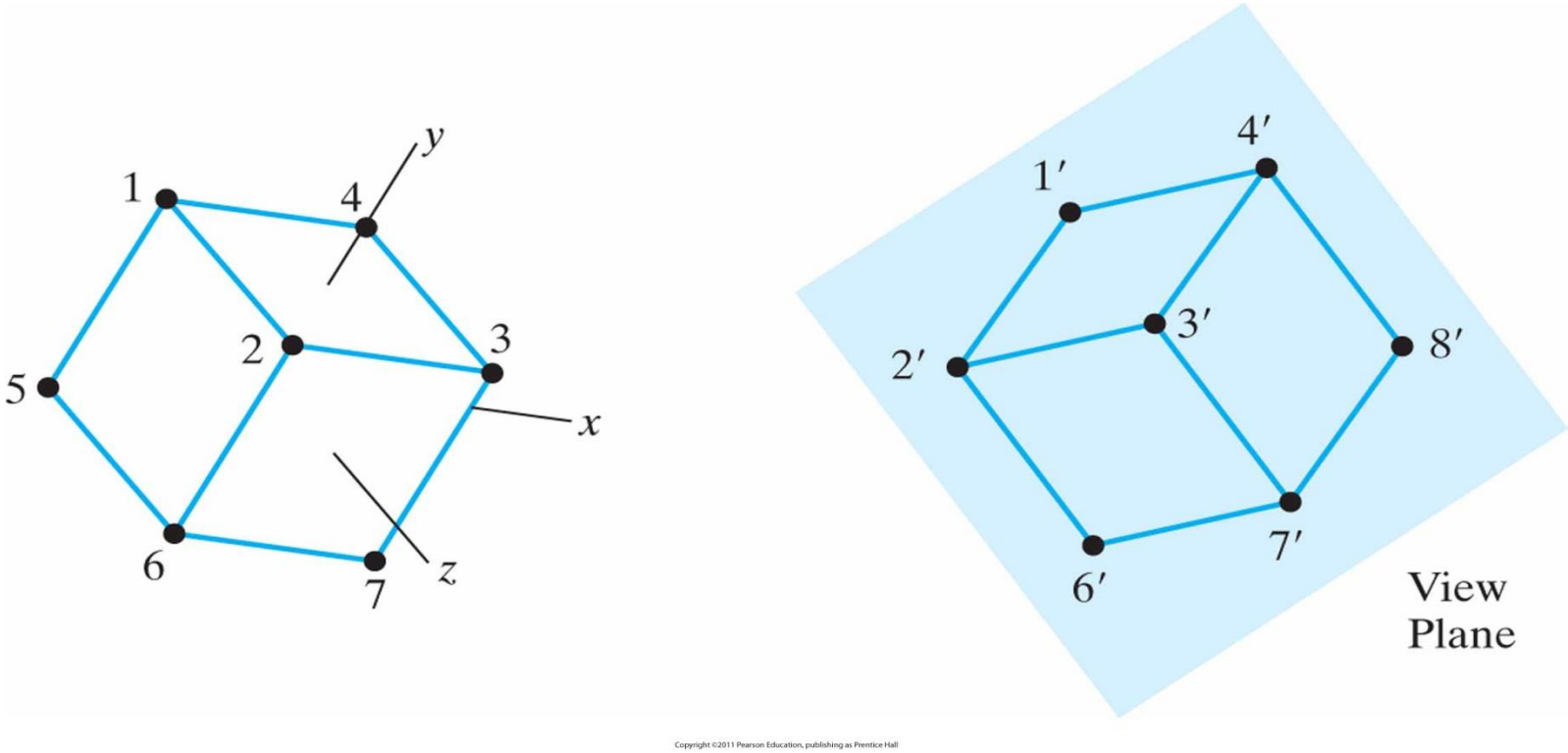


Orthogonal projections of an object, displaying plan and elevation views.

Orthographic Projections

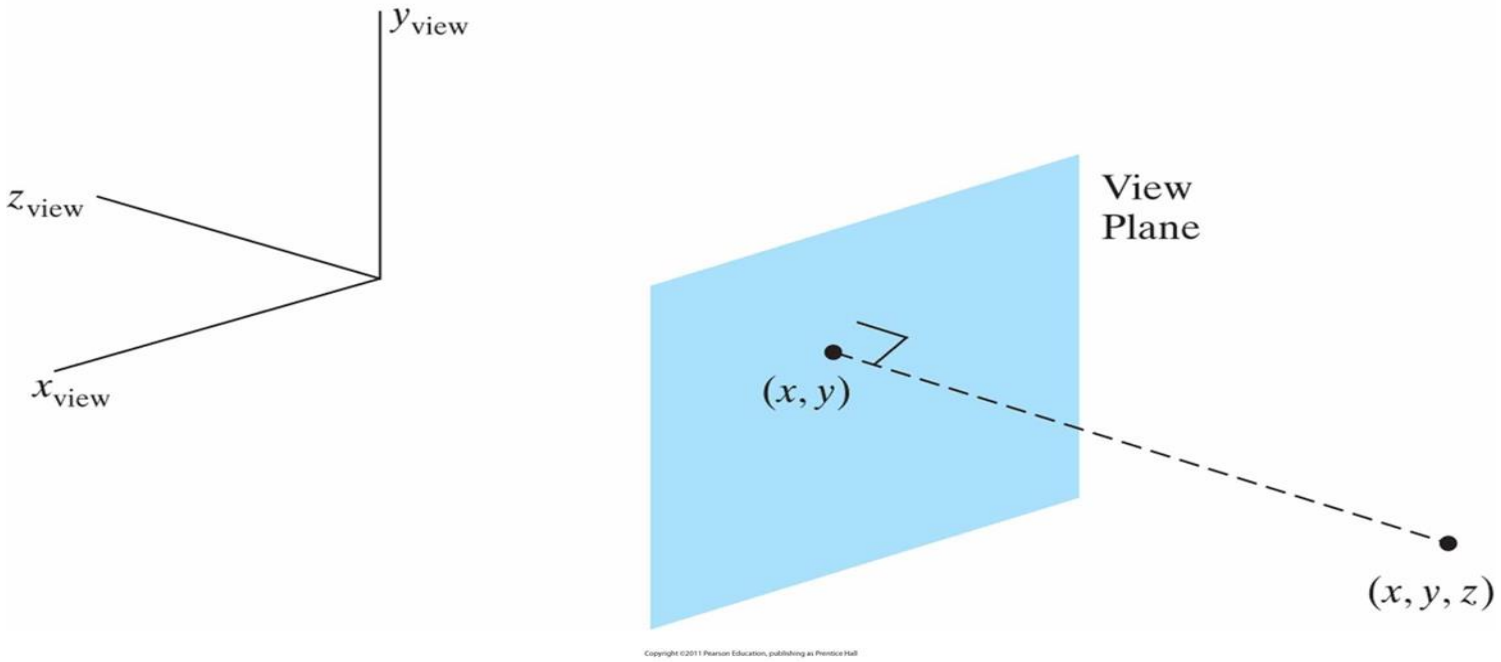
- Axonometric and Isometric orthogonal projections
  - **Axonometric projections** display more than one face of an object
  - The most used axonometric projection type is **isometric projection**

Isometric Projections



Isometric projection is obtained by aligning the projection or the object, so that the plane intersects each coordinate axis (called principal axes) in which the object is defined.

Orthogonal Projection Coordinates

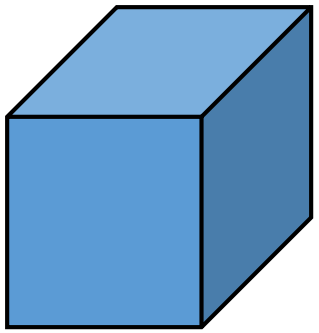


- With projection direction parallel to z_{view} axis, all transformation equations are trivial, i.e.

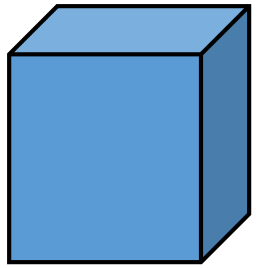
$$x_p = x \qquad \text{and} \qquad y_p = y$$

Oblique Projections

- DOP not perpendicular to view plane



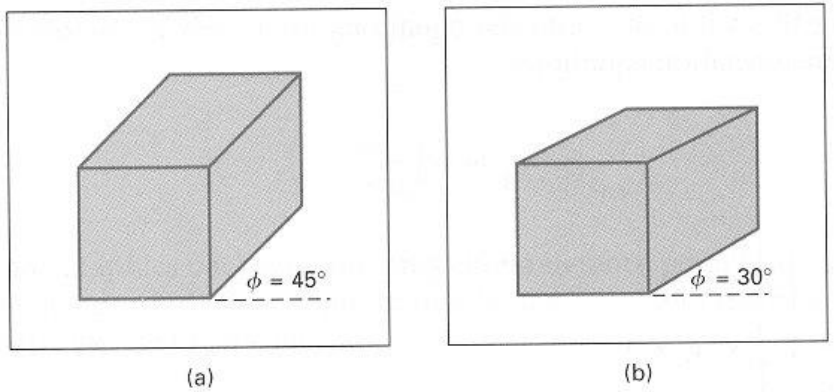
Cavalier
(DOP at 45)°



Cabinet
(DOP at 63.4)°

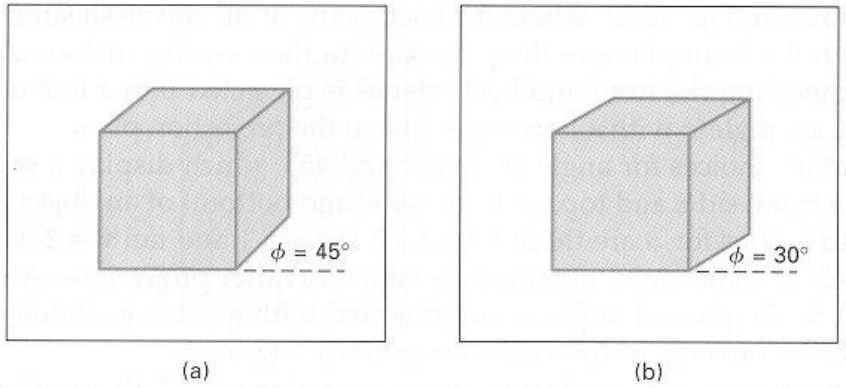
- Cavalier projection

$$\tan\alpha = 1, \quad \alpha = 45°$$



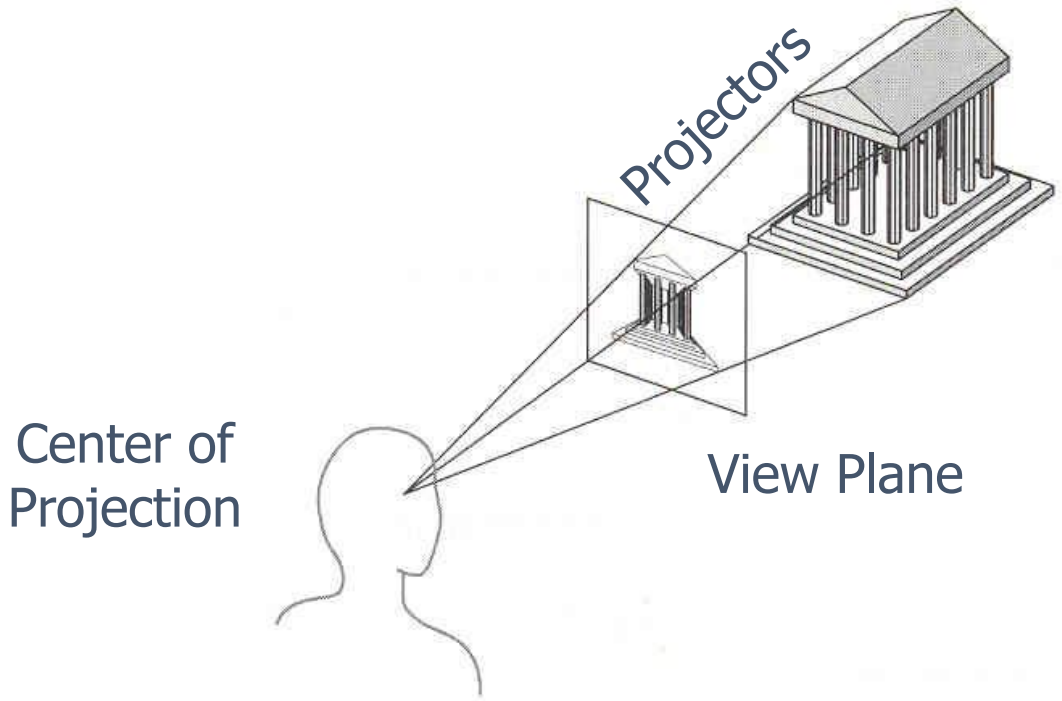
- Cabinet projection

$$\tan\alpha = 2, \quad \alpha = 63.4°$$

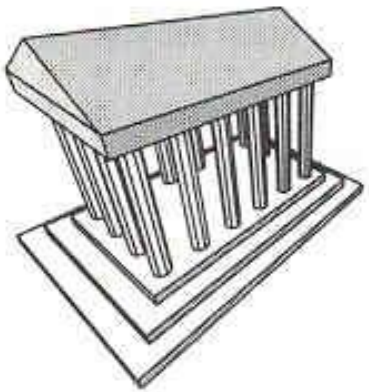


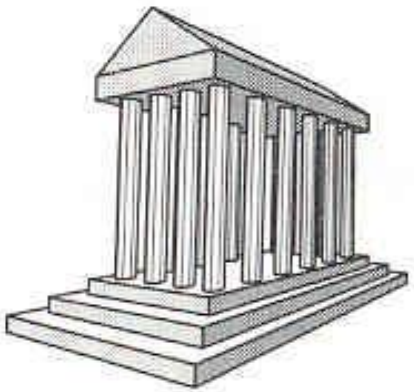
Perspective Projection

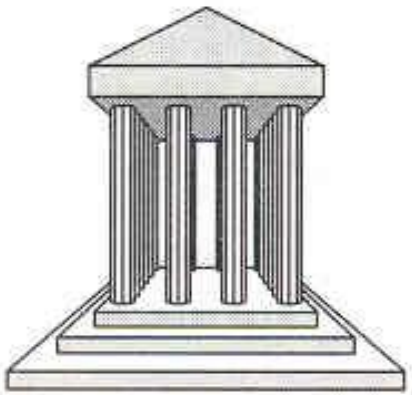
- Map points onto “view plane” along “projectors” emanating from “center of projection”(cop)



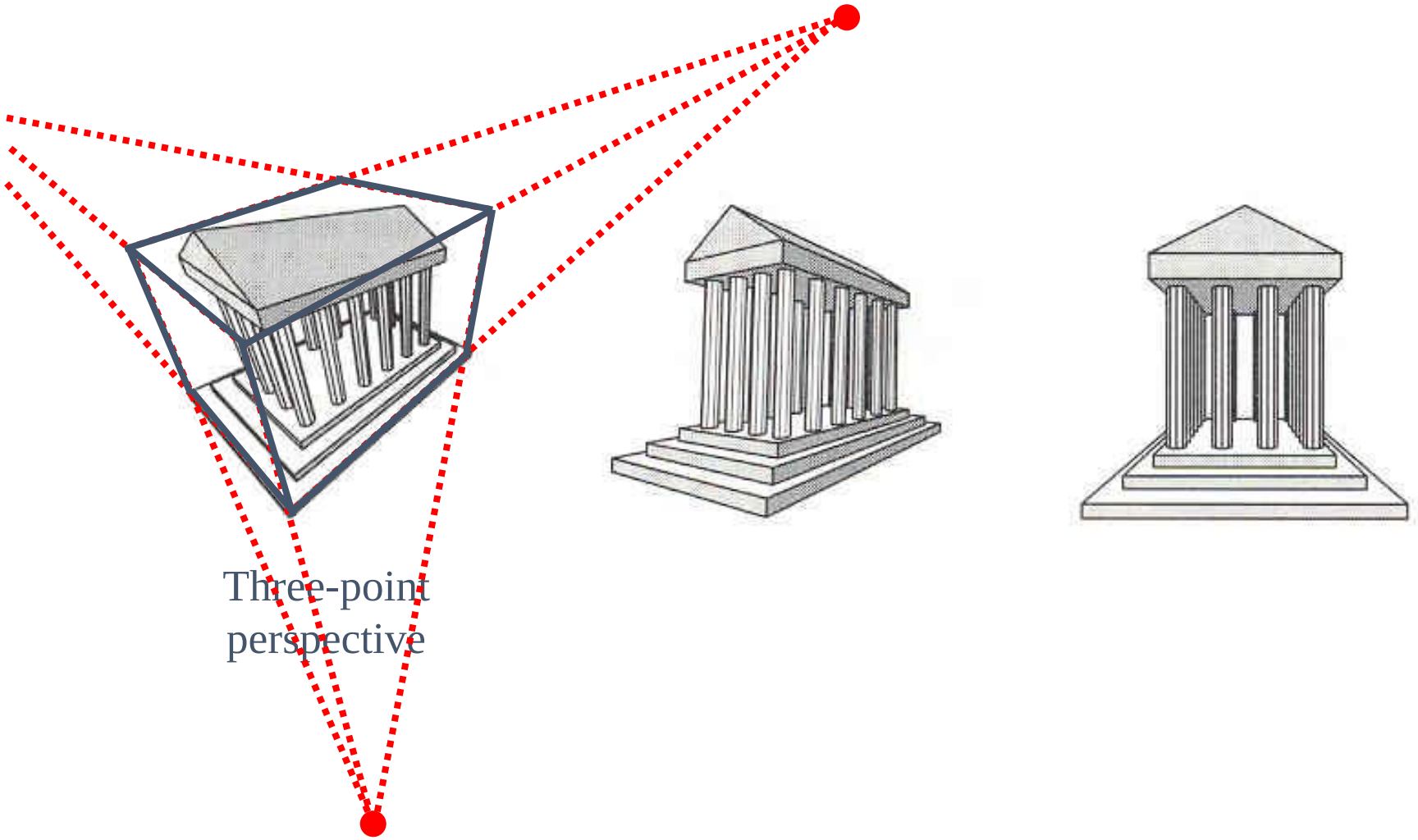
- How many vanishing point?





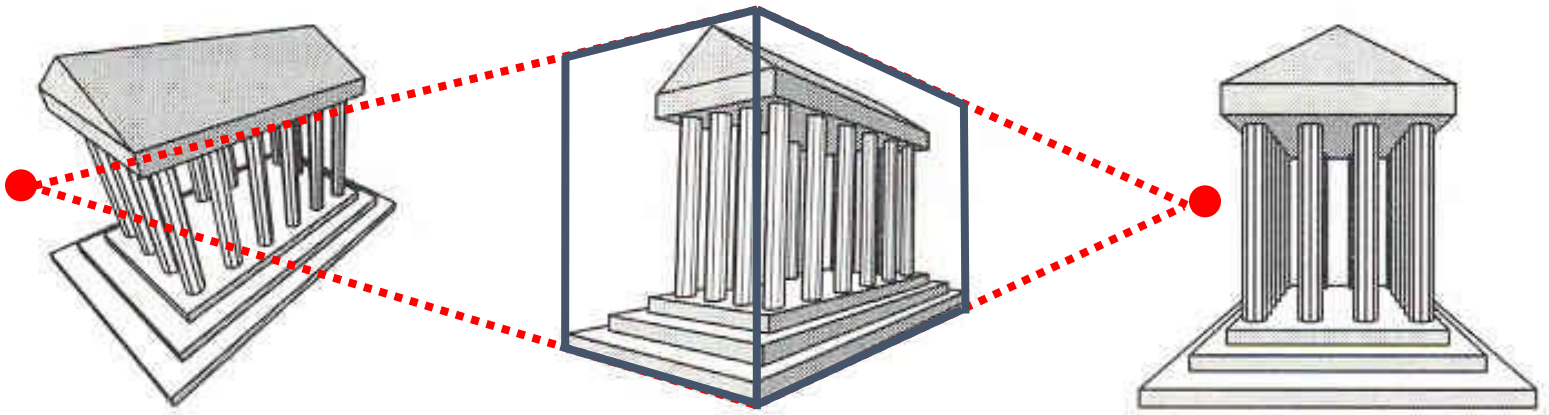


- How many vanishing point?



Three-point perspective

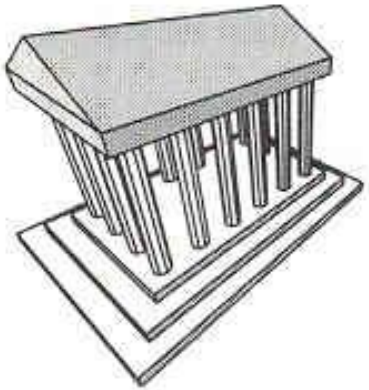
- How many vanishing point?



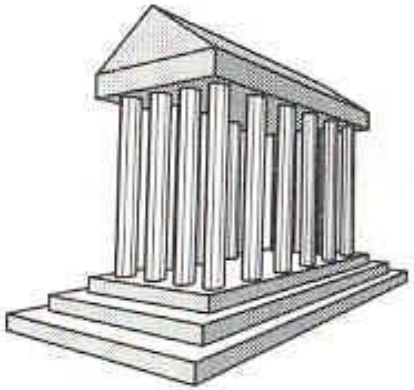
Three-point perspective

Two-point perspective

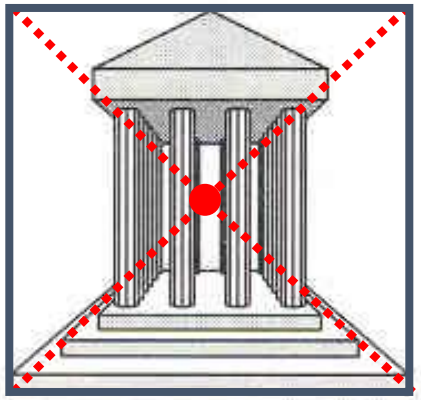
- How many vanishing point?



Three-point perspective



Two-point perspective



One-point perspective

Summary

- Discussed about the concept of projections and its types.