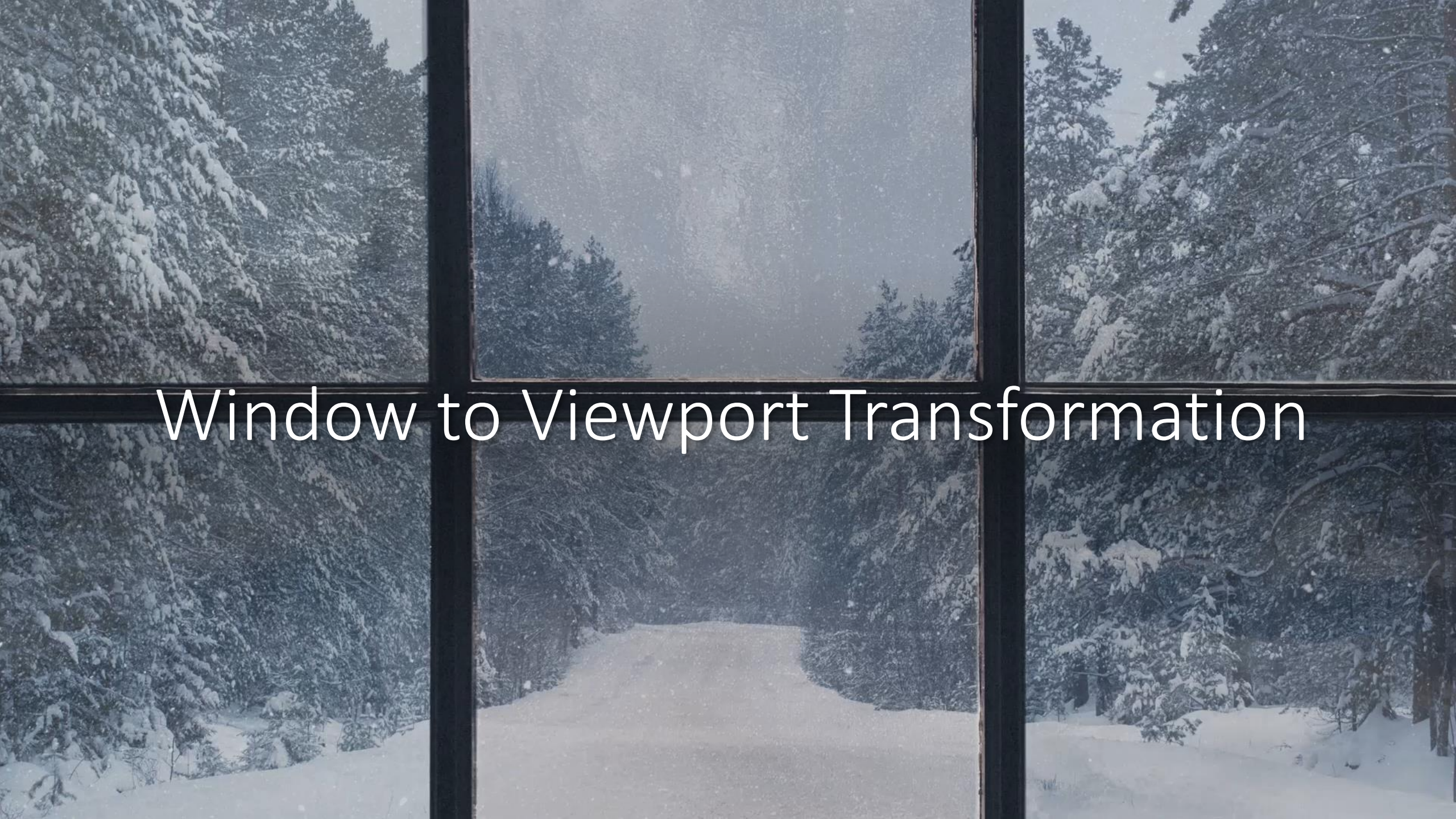
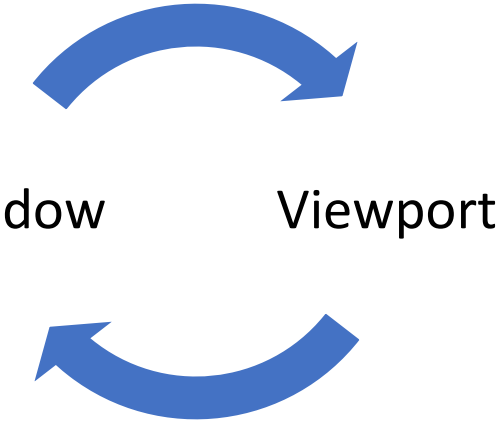


Window to Viewport Transformation

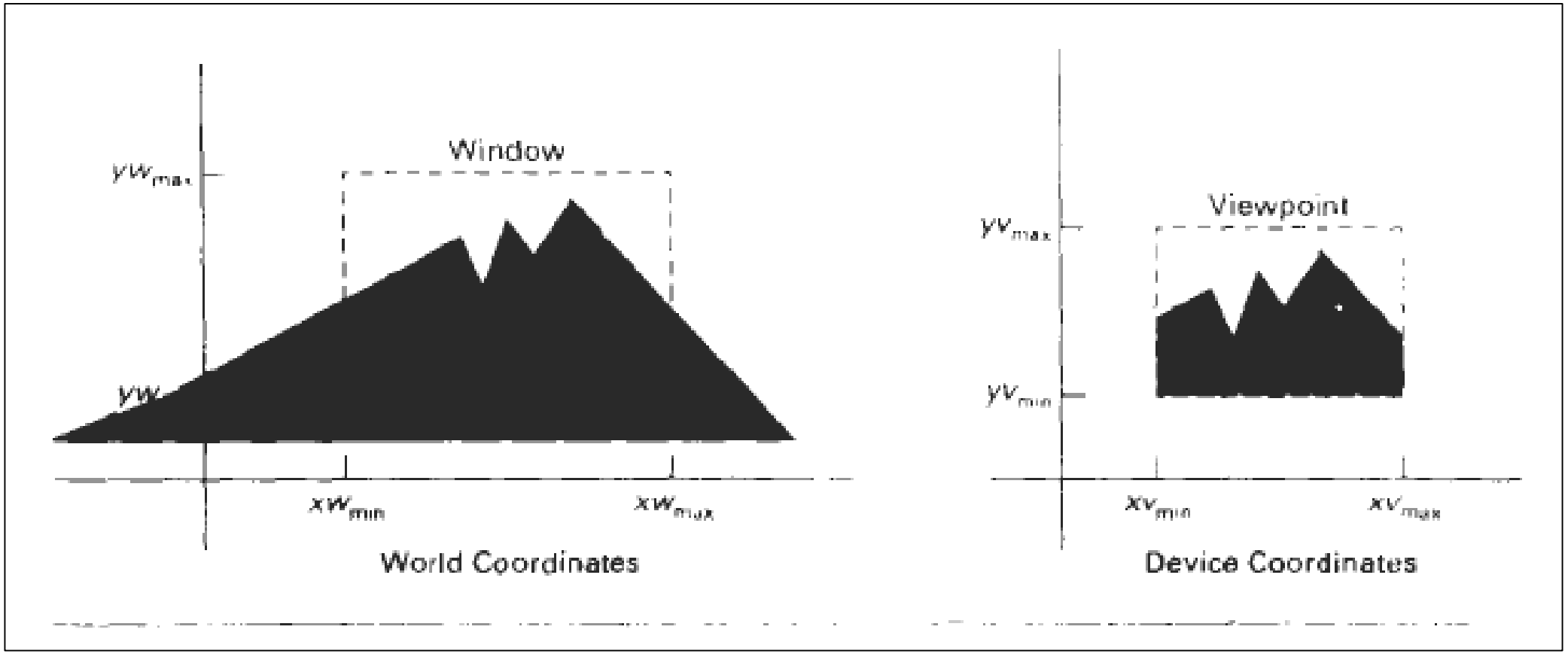
Terms to understand

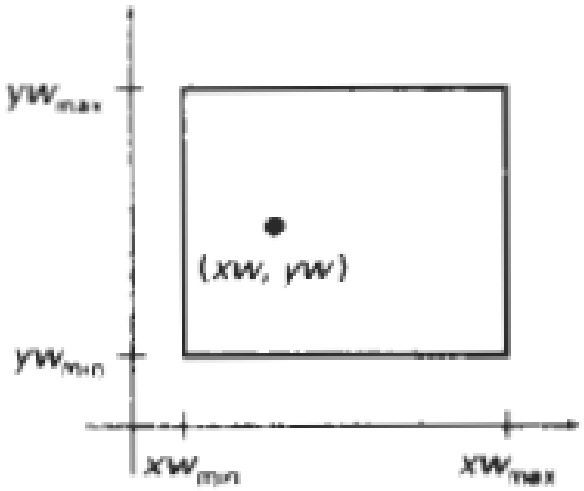
- Window: A world co-ordinate area selected for display. It defines WHAT is to be viewed.
- Viewport: An area on a display device to which a window is mapped. It defines WHERE it is to be viewed.

- A mapping of part of world co-ordinates scene to device co-ordinates is referred to as ‘Viewing Transformation’.

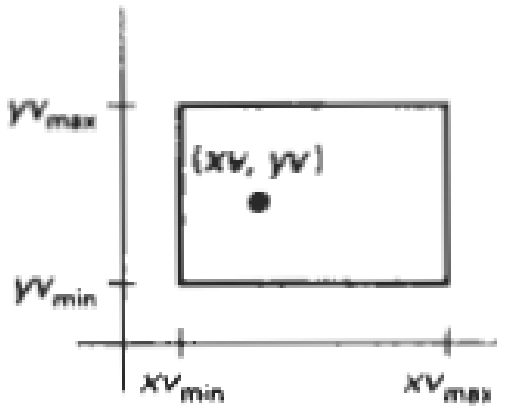


Window-to-Viewport





Window



Viewport

Sequence of transformation

1. Perform a scaling transformation using a fixed-point position of (xw_{min}, yw_{min}) that scales the window area to the size of the viewport.

2. Translate the scaled window area to the position of the viewport.

Translating window at the viewport

$$xv = xv_{min} + (xw - xw_{min})sx$$

$$yv = yv_{min} + (yw - yw_{min})sy$$

where the scaling factors are

$$sx = \frac{xv_{max} - xv_{min}}{xw_{max} - xw_{min}}$$

$$sy = \frac{yv_{max} - yv_{min}}{yw_{max} - yw_{min}}$$

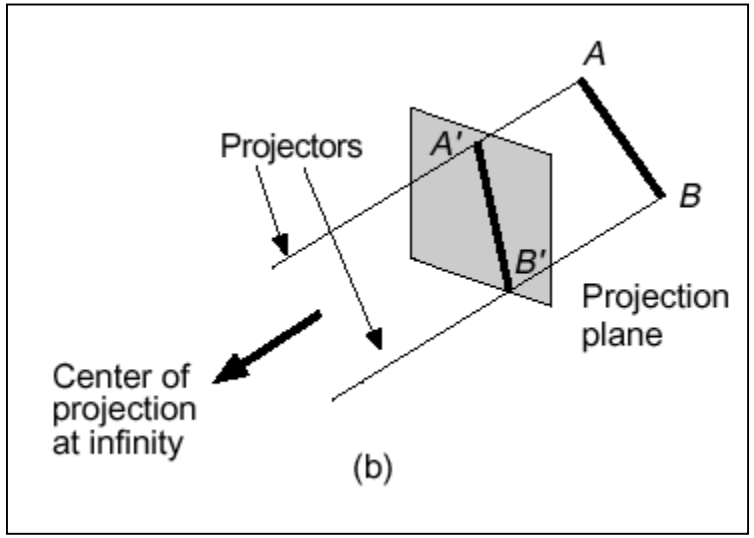
Scaling factors

Projection

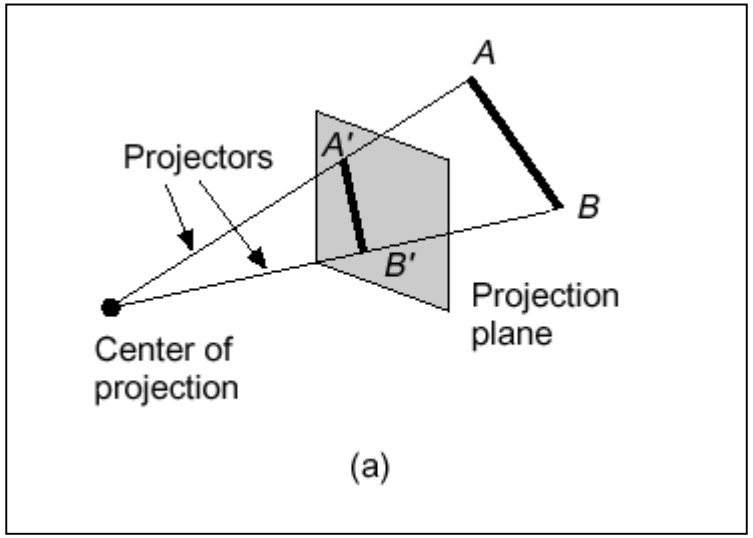
Types of Projections

Parallel: Typically used for architectural and engineering drawings.

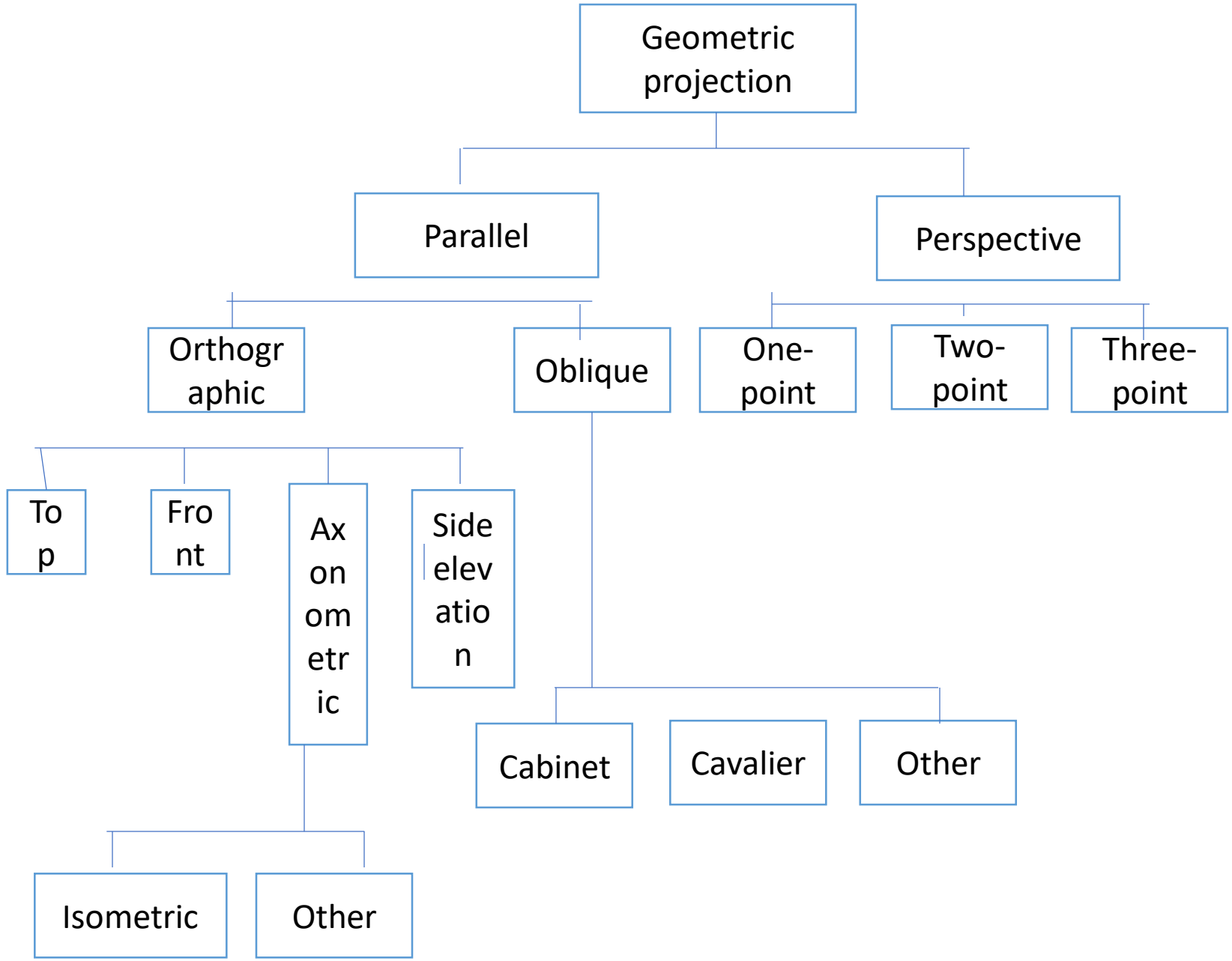
Perspective: Realistic looking and used in computer graphics.



Parallel Projection

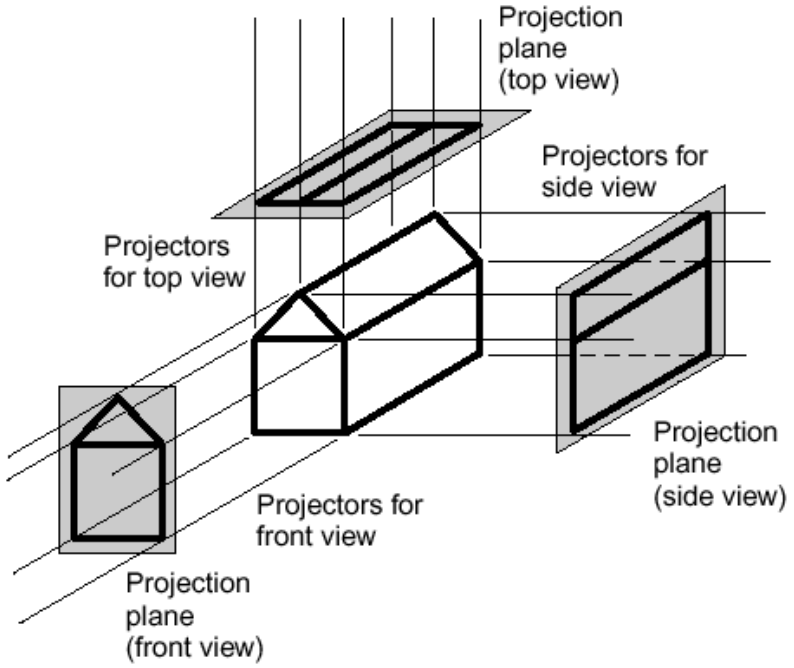


Perspective Projection

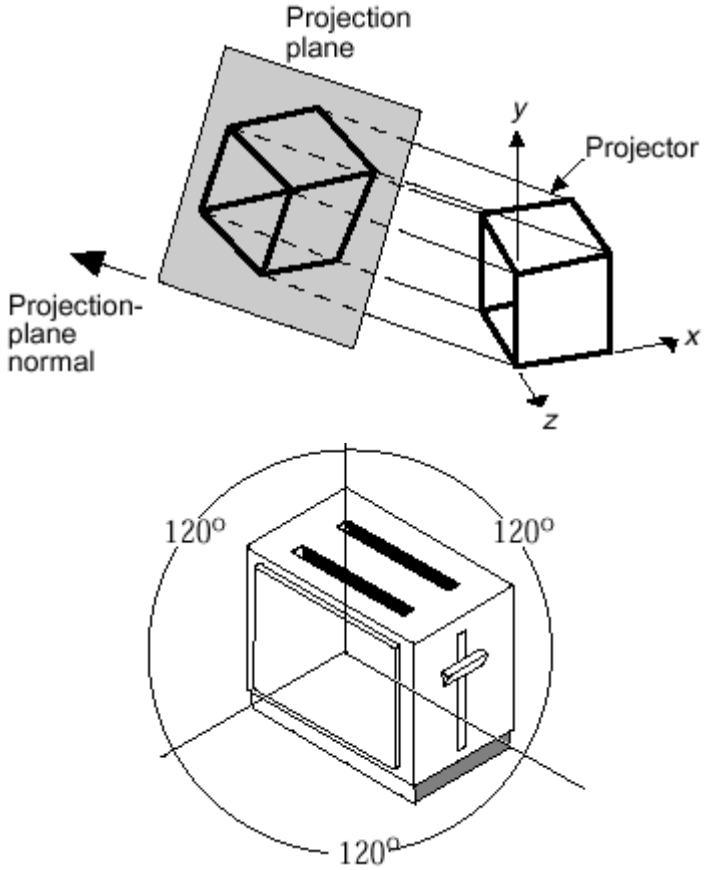

Geometric projection
Parallel
Perspective
Orthographic
Oblique
One-point
Two-point
Three-point
Top
Front
Axonometric
Side elevation
Cabinet
Cavalier
Other
Isometric
Other

Parallel Projections

- Some examples of parallel projections

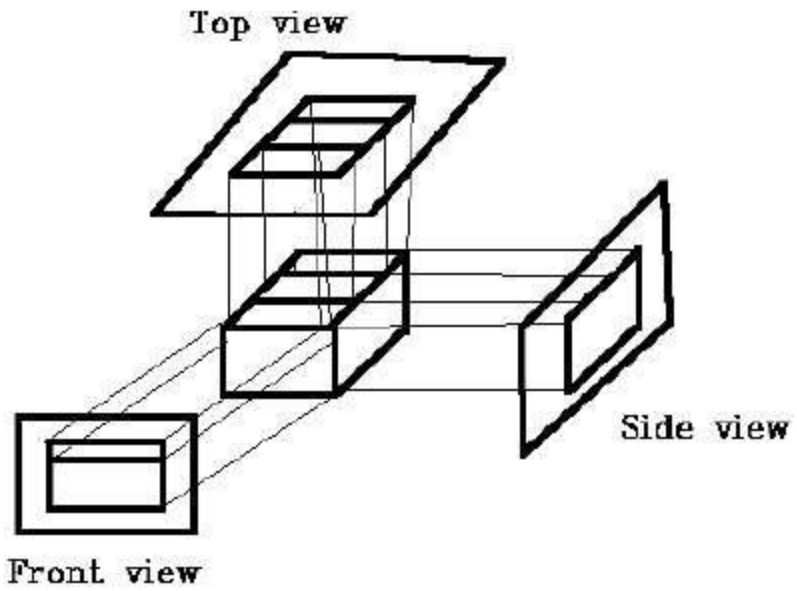


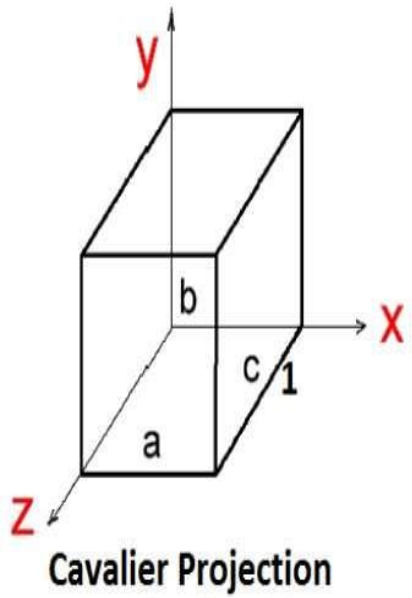
Orthographic Projection



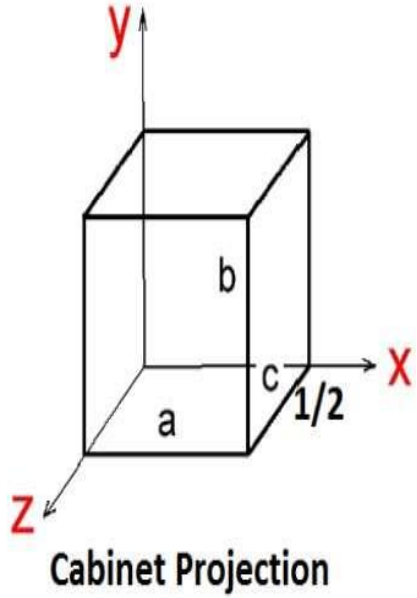
Isometric Projection

Orthographic and Oblique Projection





Cavalier Projection



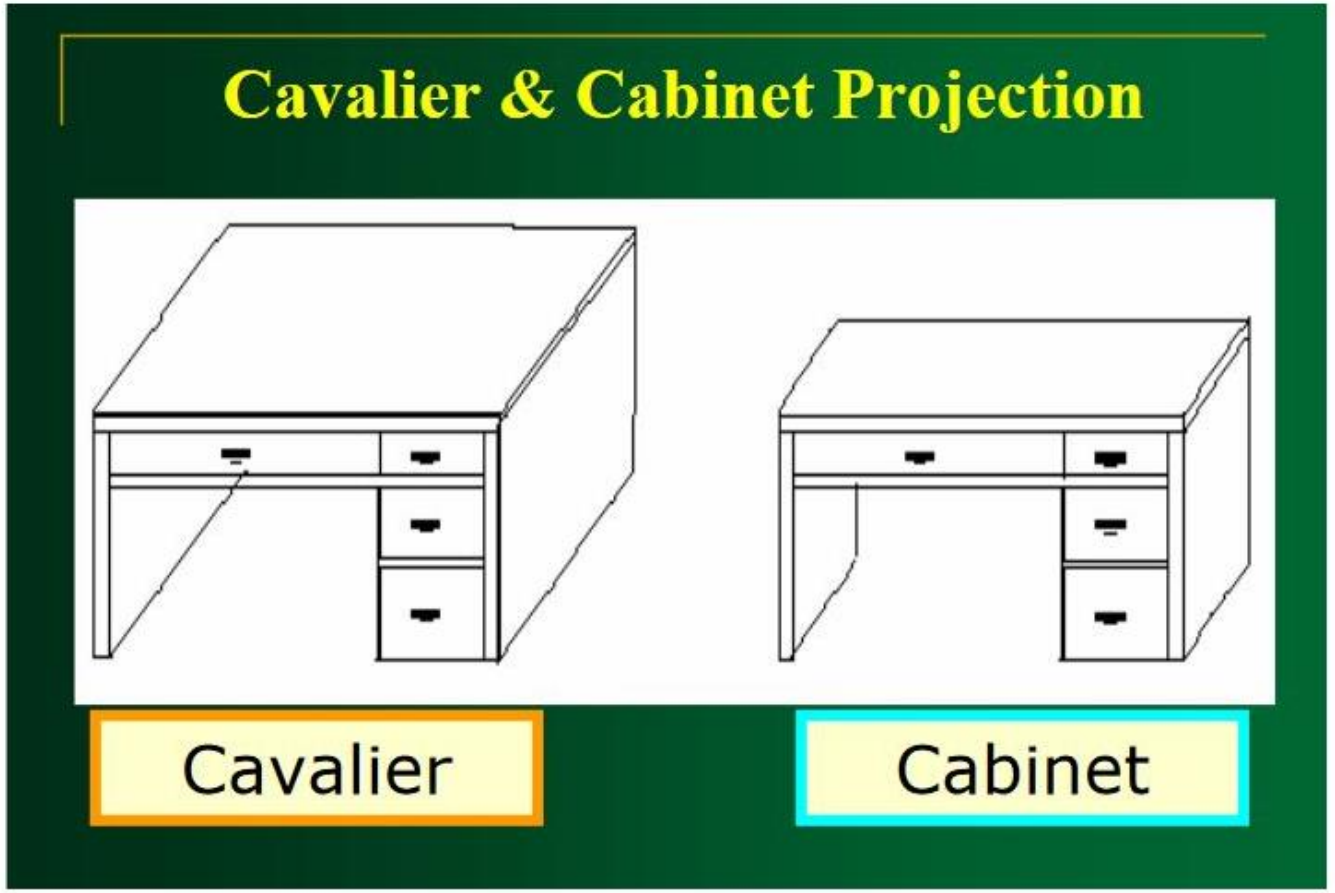
Cabinet Projection

- **Parallel projection**:
  - If the direction of projection is perpendicular to the projection plane, it is an **orthographic projection**.
  - If the direction of projection is not perpendicular to the projection plane is called as **oblique projection.**
  - A multi-view projection displays a single face of a 3D object.
  - **Axonometric projections** allow the user to place the view-plane normal in any direction such that 3 adjacent faces of a cube like object are visible.
  - **Dimetric projections** differ from isometric projections in the direction of the view-plane normal.
  - **Trimetric projections** allow the viewer the most freedom in selecting the components of n.

Cavalier and Cabinet Projection

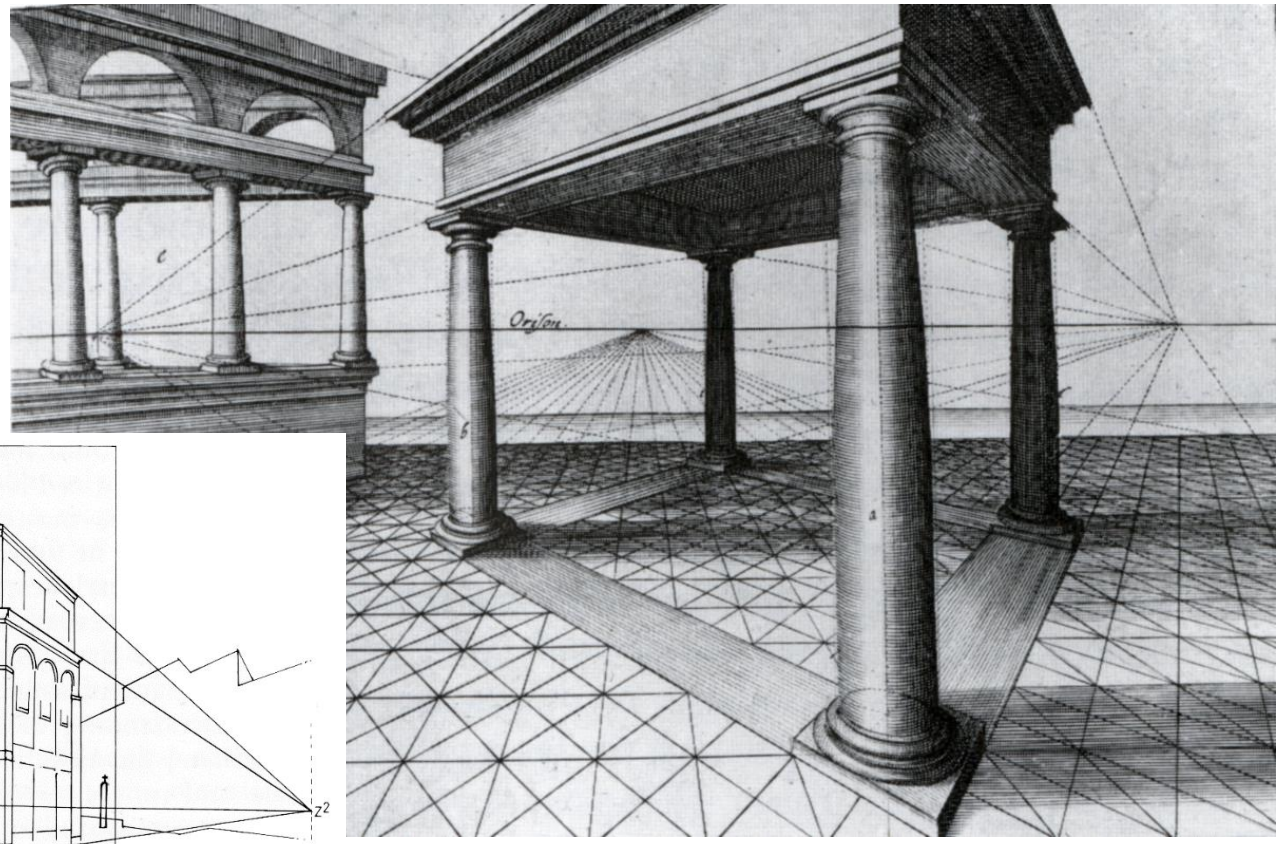
- There are two types of oblique projections − Cavalier and Cabinet. The Cavalier projection makes 45° angle with the projection plane.
- The projection of a line perpendicular to the view plane has the same length as the line itself in **Cavalier projection**. In a cavalier projection, the foreshortening factors for all three principal directions are equal.
- The **Cabinet projection** makes 63.4° angle with the projection plane. In Cabinet projection, lines perpendicular to the viewing surface are projected at ½ their actual length

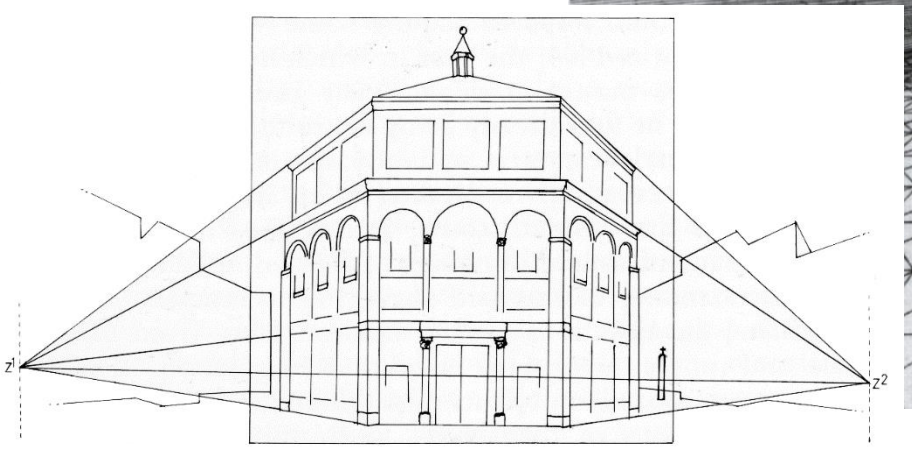
Cavalier and Cabinet Projection



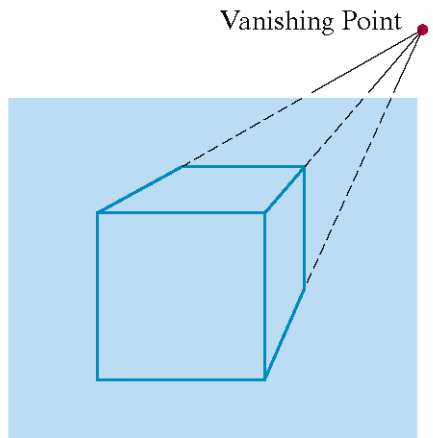
Perspective Projections

- Perspective projections are much more realistic than parallel projections

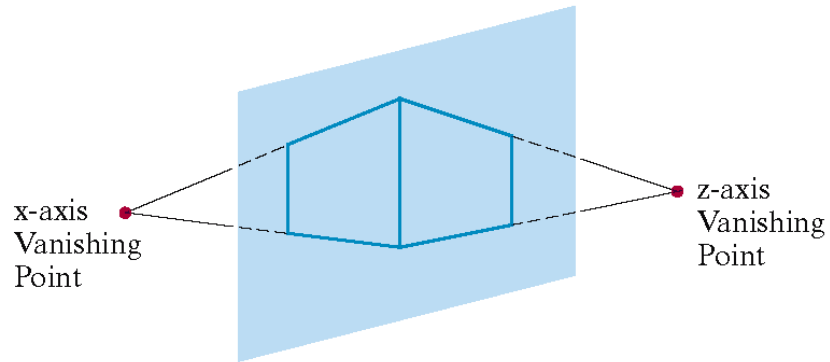




- **Perspective projection:**
  - It is a type of projection where 3D objects are not projected along parallel lines, but along lines emerging from a single point.
  - **A vanishing point** is a point in a perspective drawing to which parallel lines appear to converge.
  - **One-point perspective** exists when a painting plate is parallel to two axes of a rectilinear scene.
  - **Two point perspective**



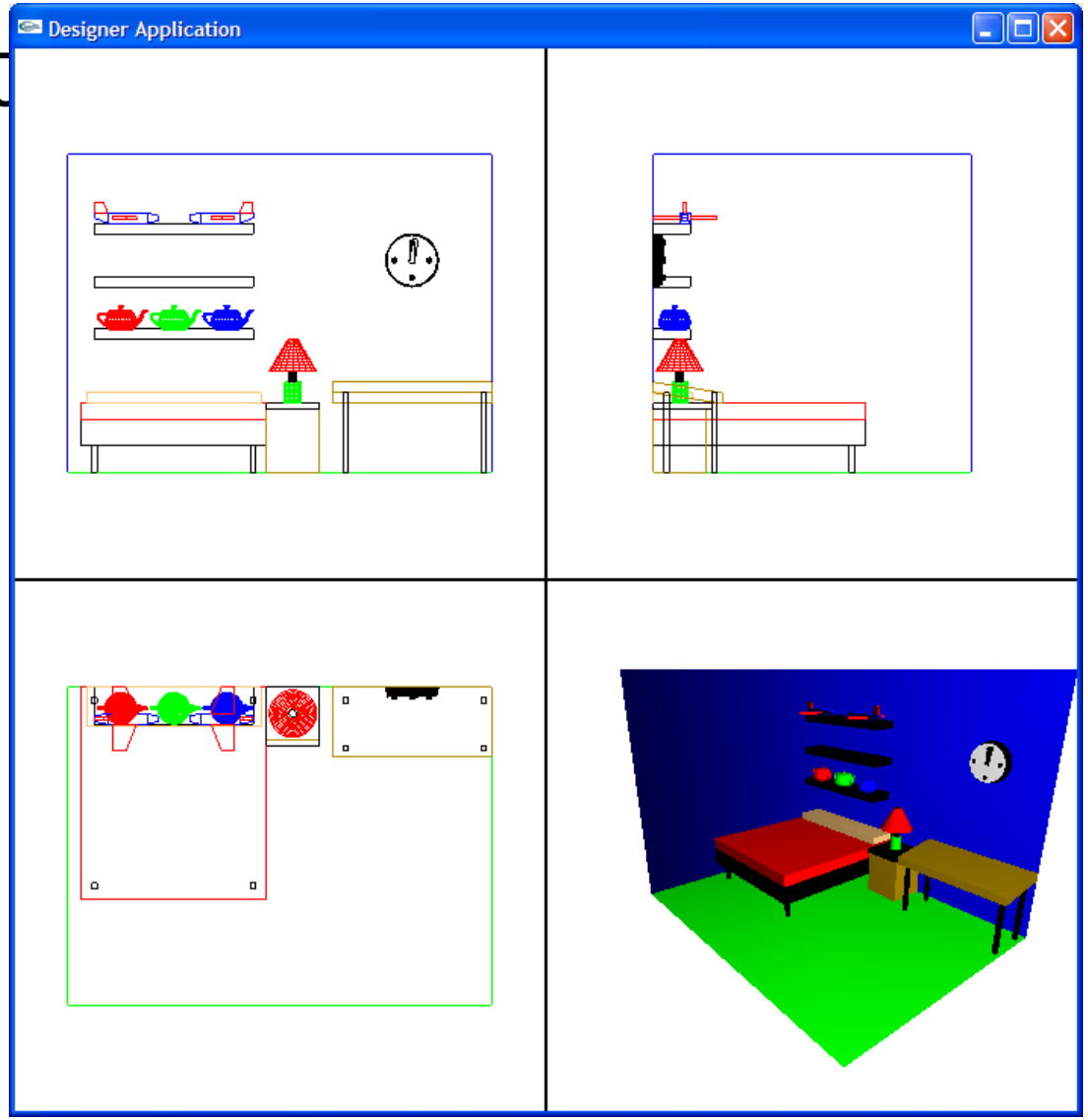
(b)
One-Point
Perspective
Projection



(c)
Two-Point
Perspective
Projection

Assignment

Orthographic Wireframe Elevation



Orthographic Wireframe End-Elevation

Orthographic Wireframe Plan

Perspective View