7. Viewing Transformations (31/01/24)

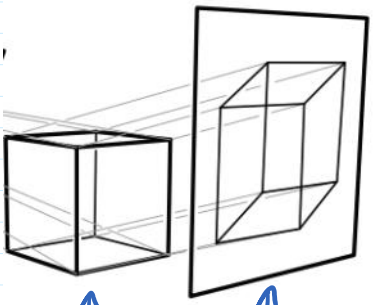
30 January 2024 17:30

Source: "Fundamentals of Computer Graphics, 4th Edition"
by Steve Marschner and Peter Shirley, A K Peters/CRC Press, 2015.

Image :- Representation of 3D object/ scene with a 2D drawing or painting.

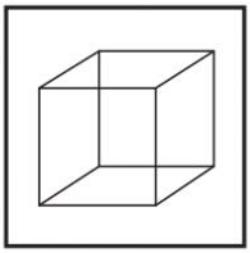
① **Parallel Projection :-**

3D points are mapped to 2D along a direction until they hit the image plane.



object

Image Plane



orthographic view

Parallel projection

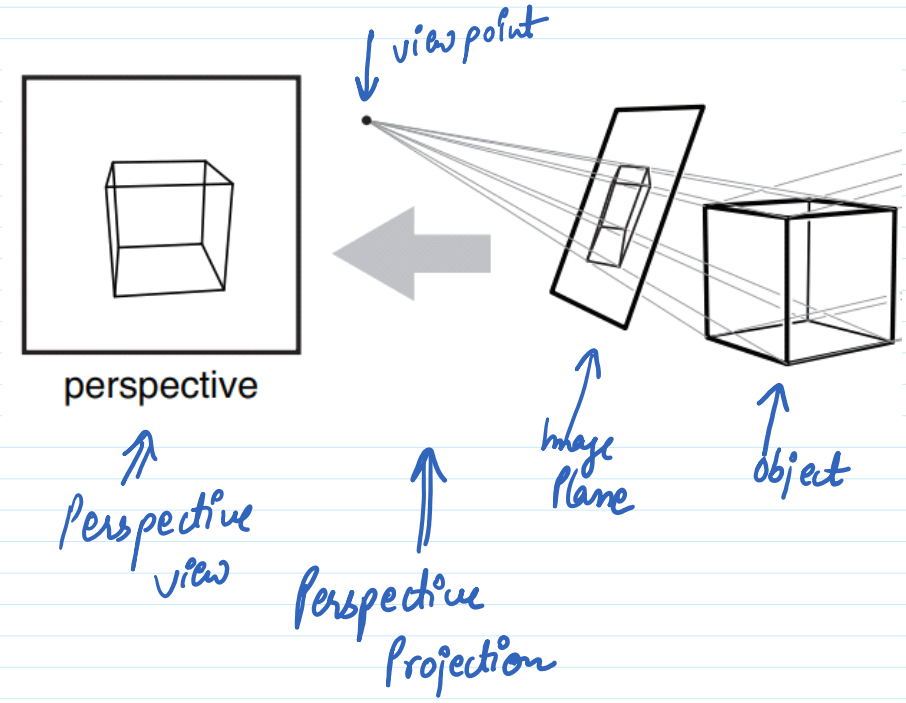
Used in mechanical and architectural drawings.
→ keep lines parallel
→ preserves the size and shape

In real life, objects look smaller as they get farther away.

② Perspective Projection :-

→ parallel lines does not appear parallel after after a certain distance

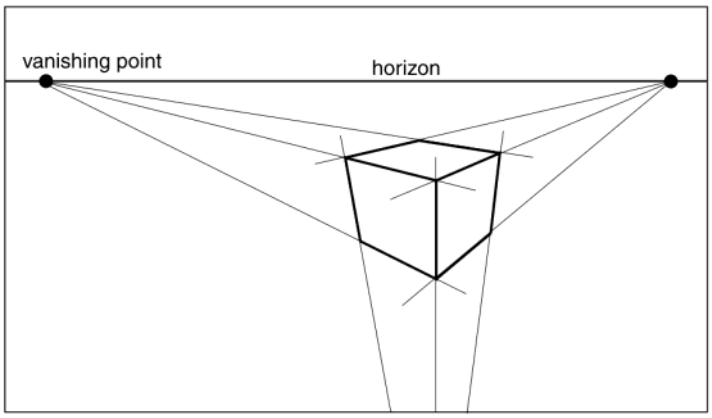
→ eyes / cameras do not collect light from a single viewing direction, they collect light passing through a "viewpoint".

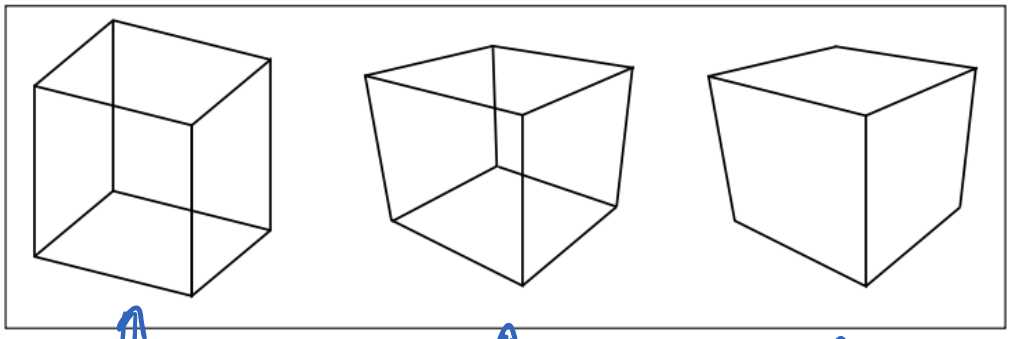


Vanishing Points :- The point where parallel lines meet in a perspective projection.

Every set of parallel lines has its own vanishing points.

Parallel horizontal lines will meet at a point on the horizon.





Orthographic Projection

Perspective Projection

Perspective View (No hidden lines)

Viewing Transformations:

Mapping 3D locations represented as (x, y, z) coordinates in the

World coordinate system → image coordinates (pixels)

Depends on different things :-

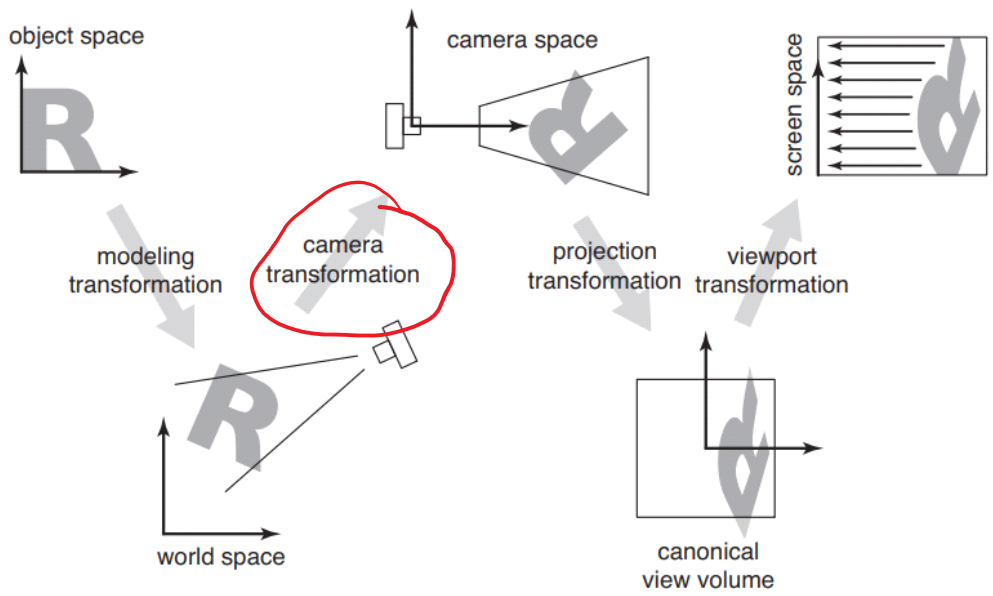
- → Camera position and orientation
- → type of projection
- → resolution of image
- → field of view.

Three sequence of transformations :-

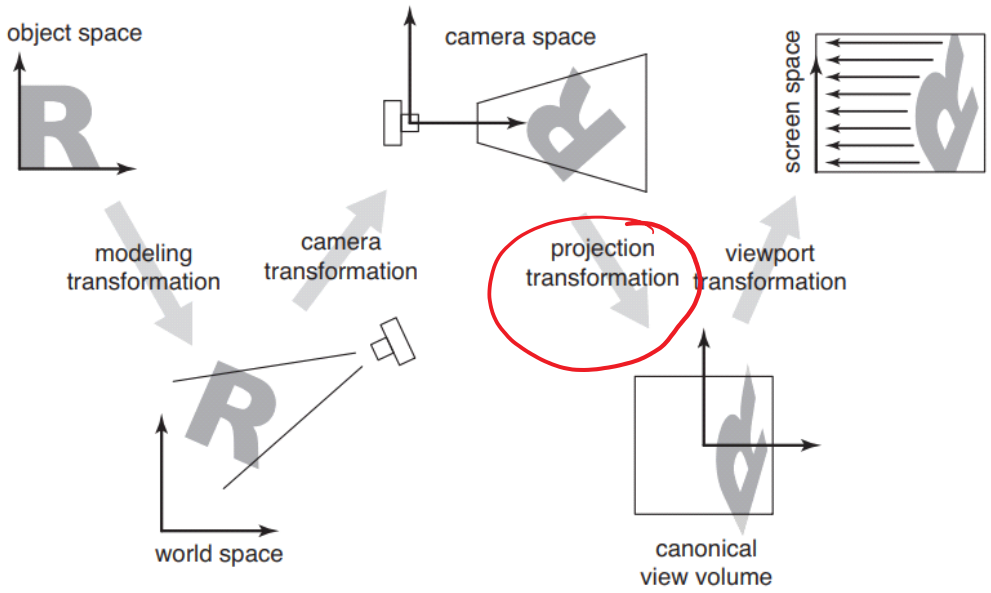
① Camera Transformation :-

Places the camera at the origin in a convenient orientation.

Depends only on the position and orientation of the camera.



② Projective Transformation :-
projects points from camera space. Depends on type of desired projection.



③ Viewport Transformation :- Maps this projection to the desired rectangle in the pixel coordinates.
Depends on the size and position of the output image.

Quiz Question :-
" Define vanishing points and horizon. "
How these two related ?