Chapter - 4

Three Dimensional Transformation, Viewing and Projection

3-D Projections

We can project the 3-D objects onto the 2-D plane. So Projection can be defined as a mapping of point P onto its image P' in the projection plane or view plane.

There are two basic projection methods:

- Parallel projection
- Perspective projection

Projections

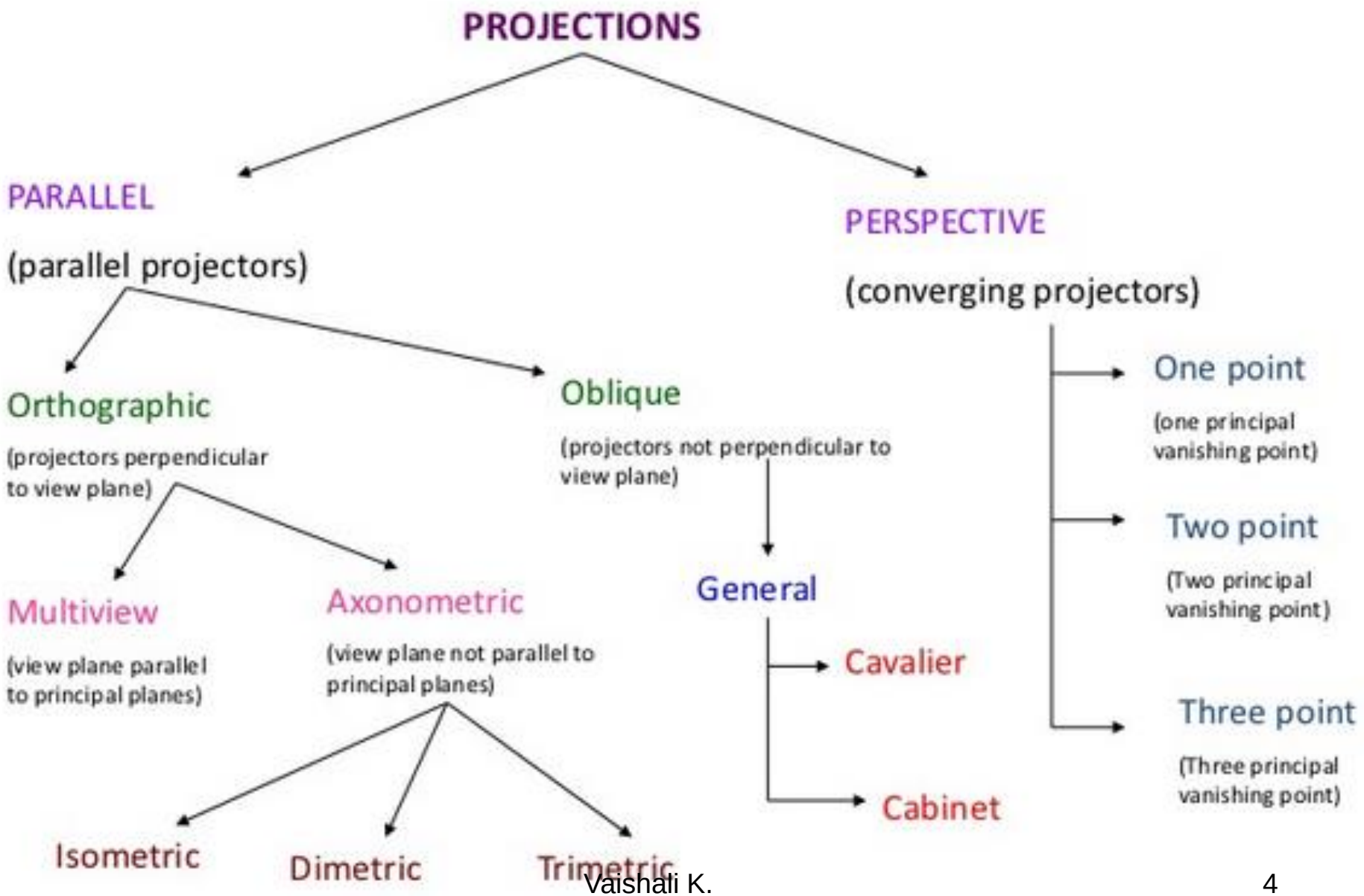
Transform 3D objects on to a 2D plane using ***projections***

2 types of projections

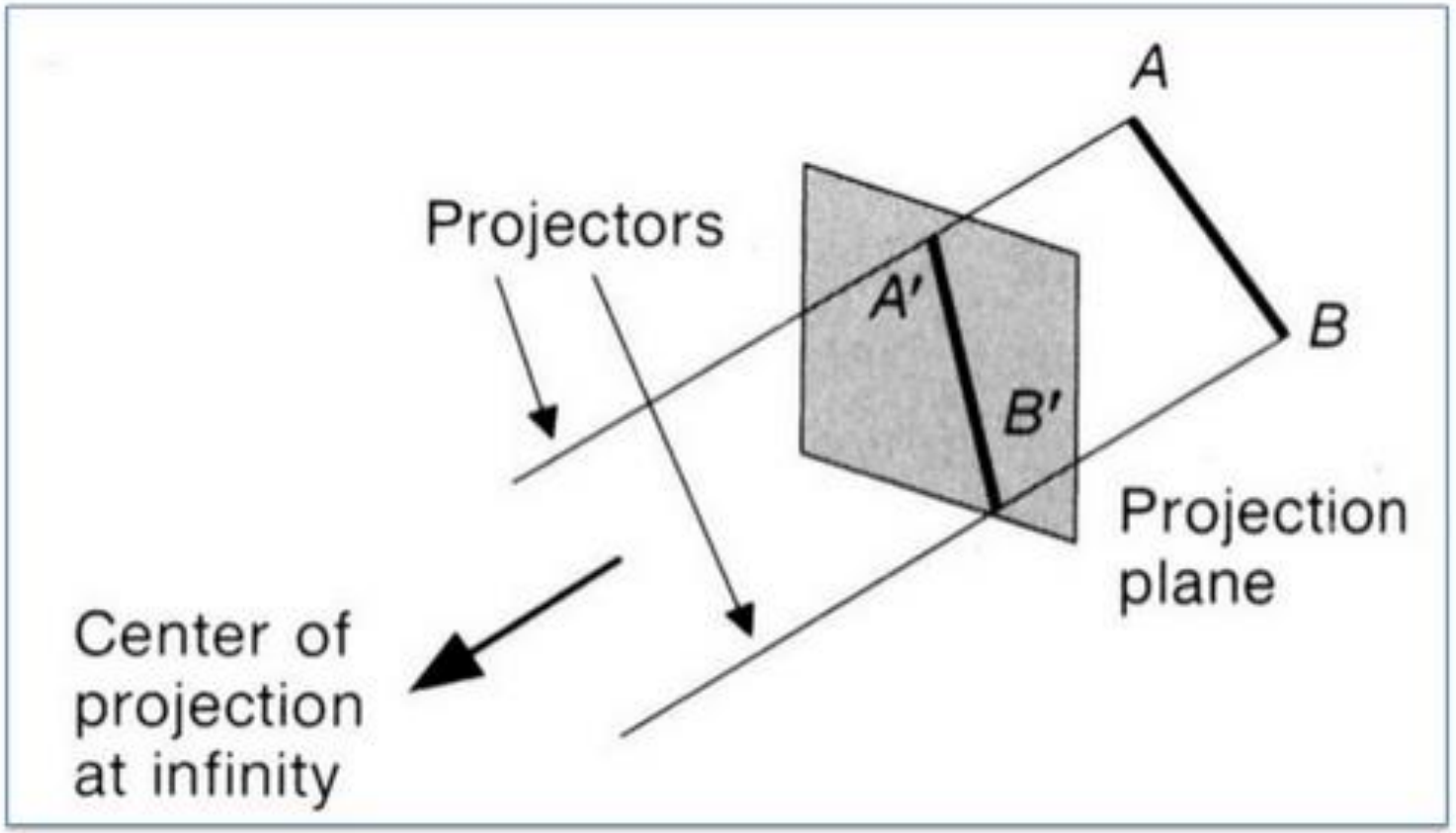
Perspective

Parallel

In **parallel projection**, coordinate positions are transformed to the view plane along parallel lines.
In **perspective projection**, object position are transformed to the view plane along lines that converge to a point called **projection reference point (center of projection)**


PROJECTIONS
PARALLEL
(parallel projectors)
PERSPECTIVE
(converging projectors)
Orthographic
(projectors perpendicular to view plane)
Oblique
(projectors not perpendicular to view plane)
One point
(one principal vanishing point)
Two point
(Two principal vanishing point)
Three point
(Three principal vanishing point)
Multiview
(view plane parallel to principal planes)
Axonometric
(view plane not parallel to principal planes)
General
Cavalier
Cabinet
Isometric
Dimetric
Trimetric

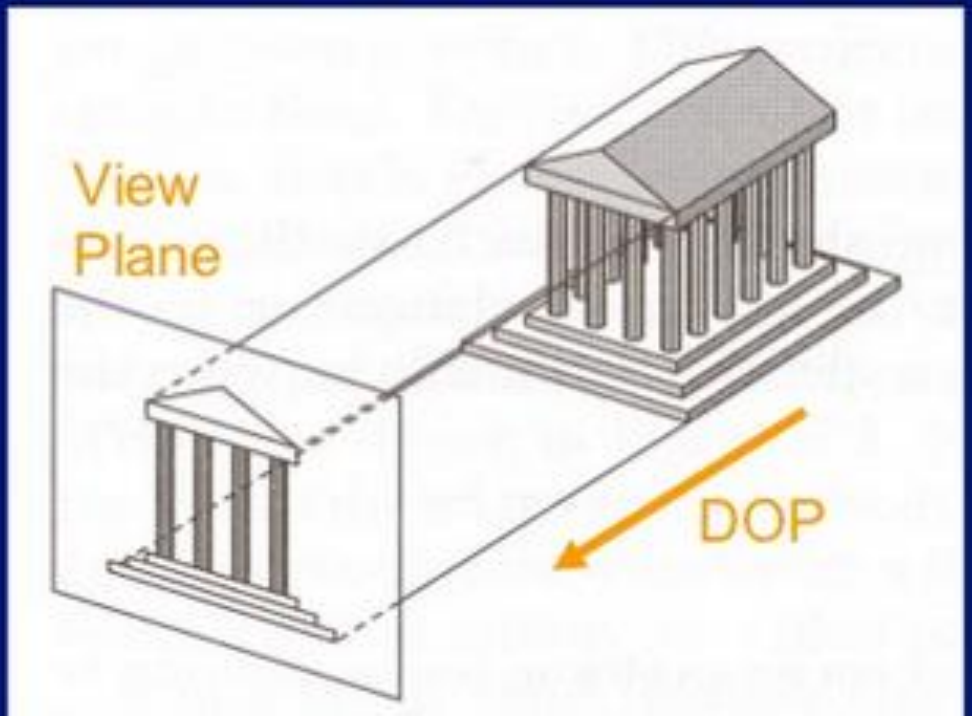
Parallel Projection



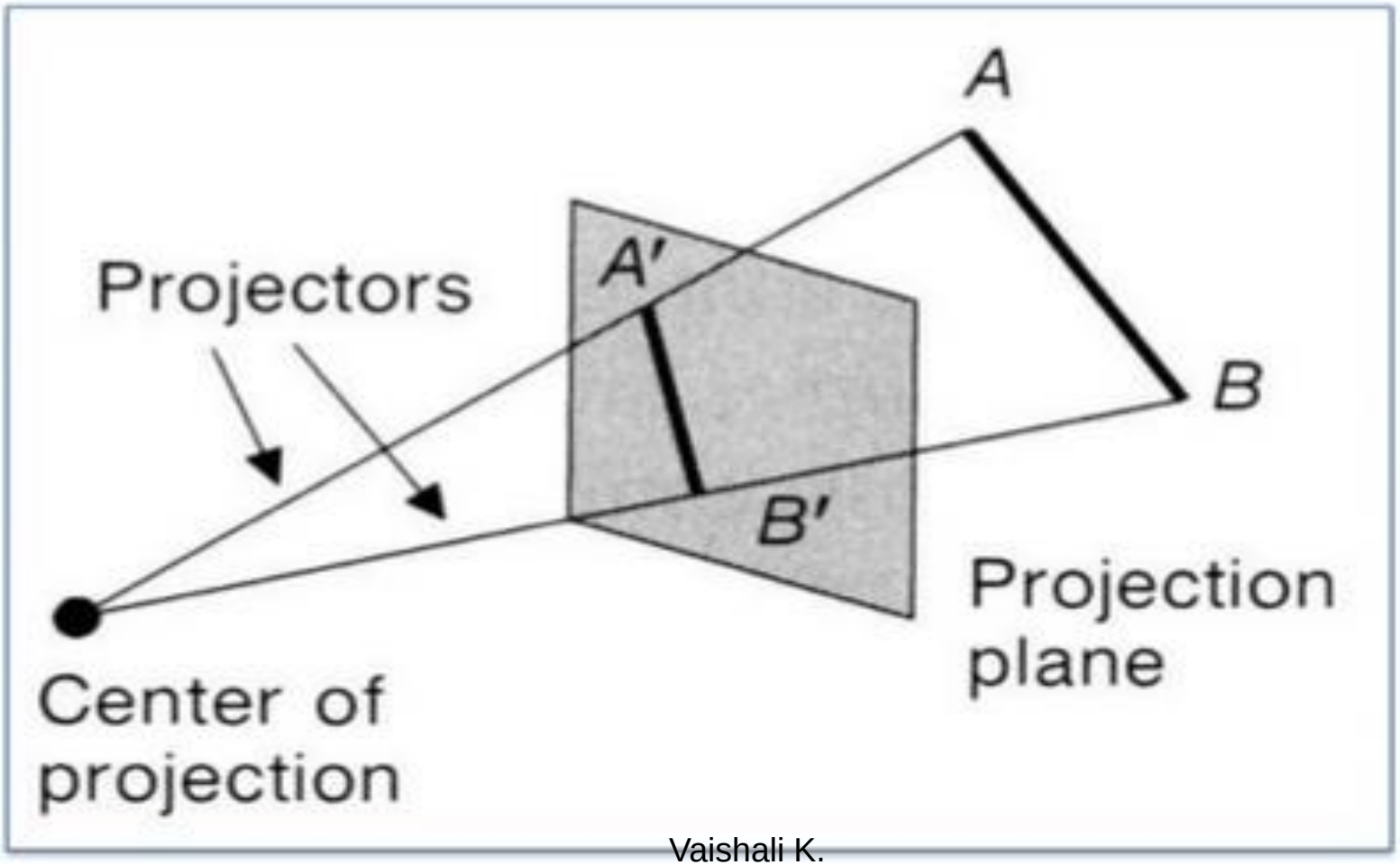
Parallel Projection

Center of projection is at infinity

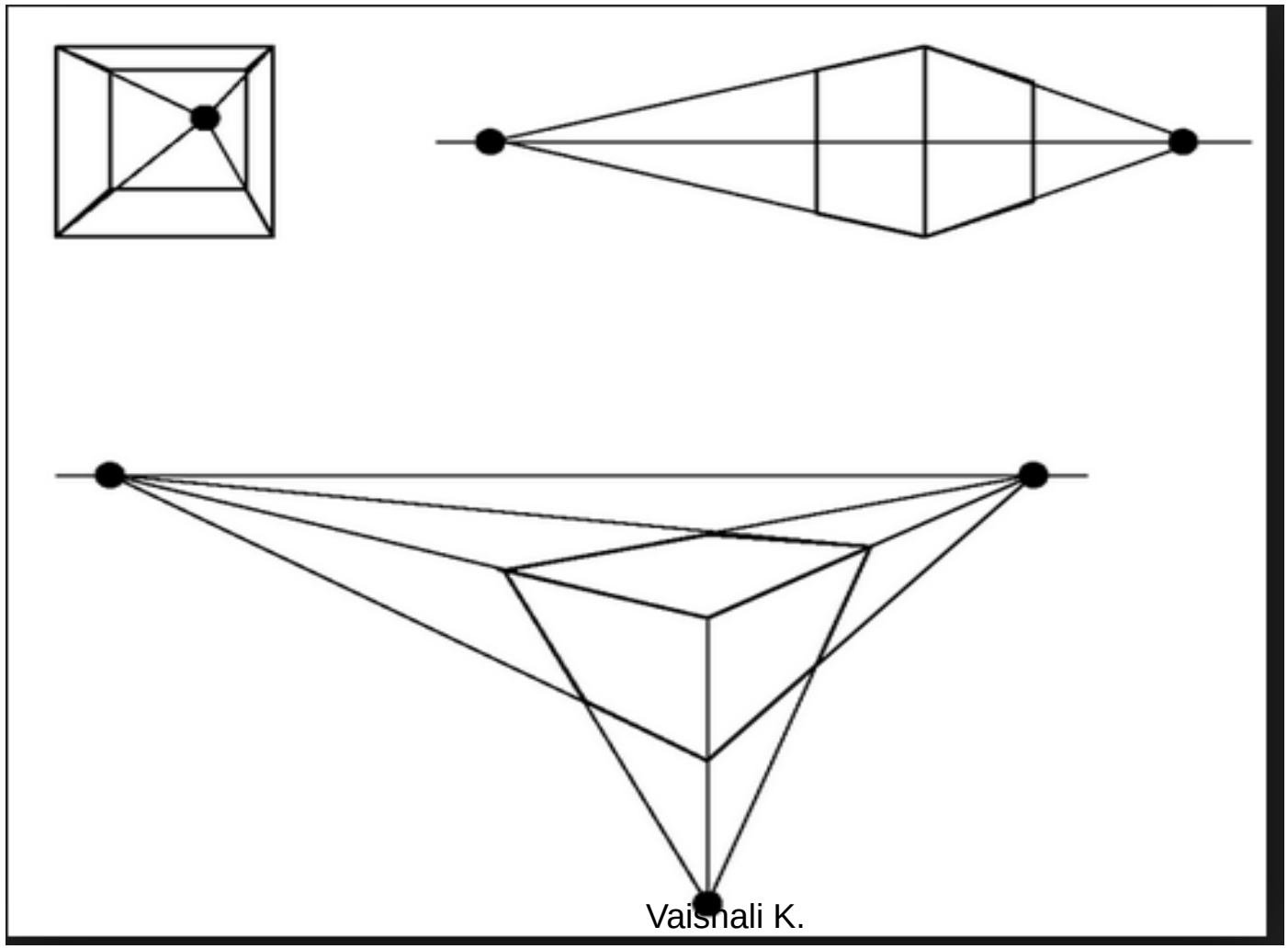
- Direction of projection (DOP) same for all points



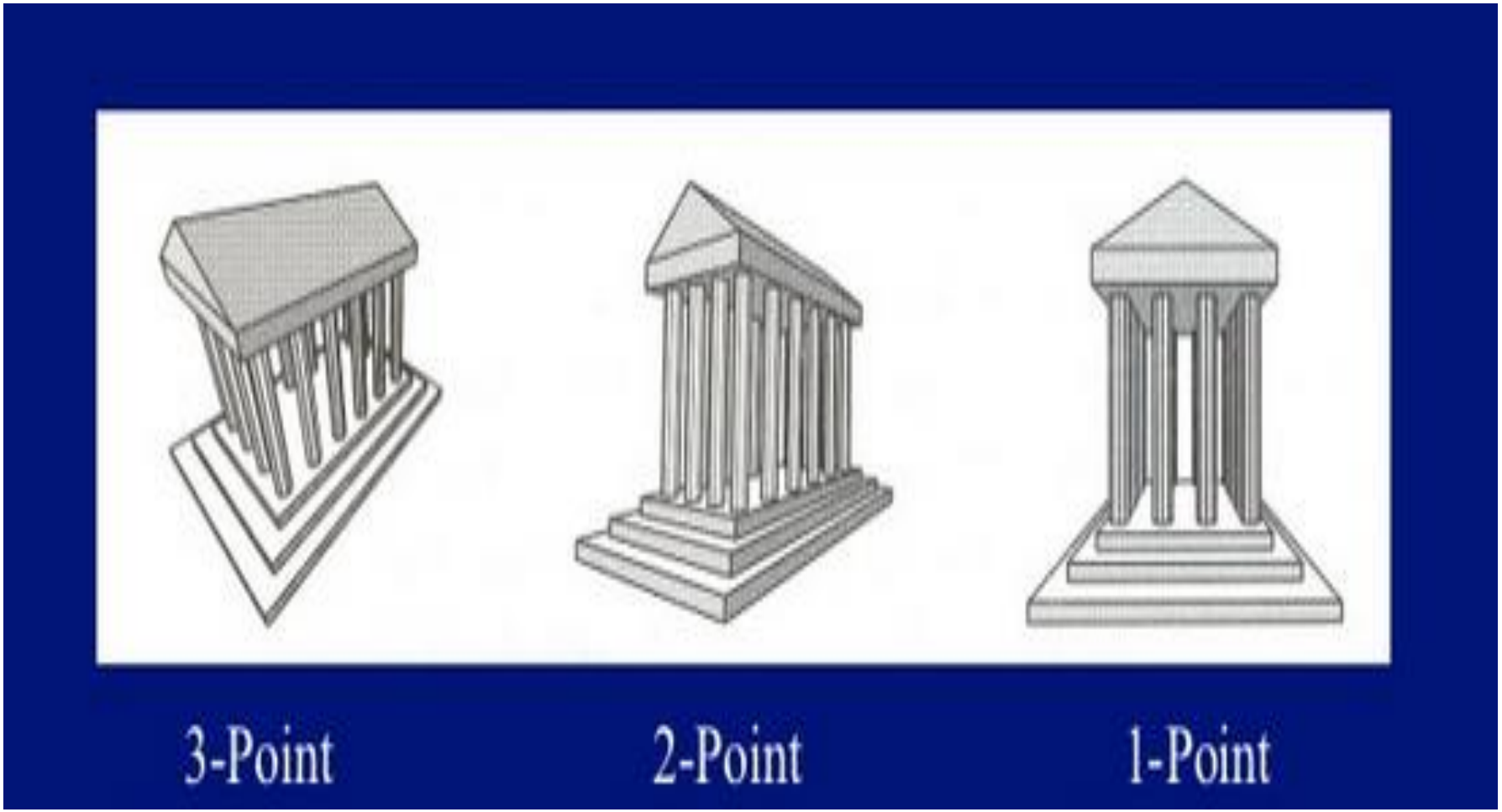
Perspective Projection



Prospective Projection-
One Point , Two Point , Three point



Prospective Projection



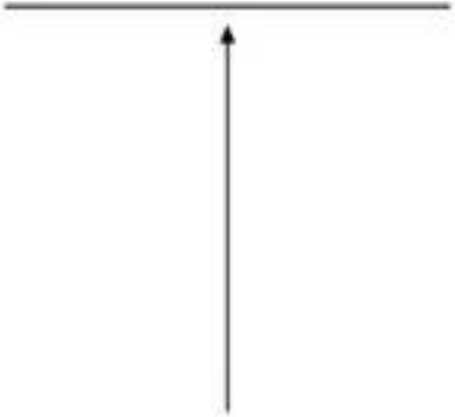
Perspective vs. parallel projections

- Perspective projections pros and cons:
- **Size varies inversely with distance – looks realistic**
- **Distance and angles are not (in general) preserved**
- **Parallel lines do not (in general) remain parallel**

- Parallel projection pros and cons:
- Less realistic looking
- Good for exact measurements
- Parallel lines remain parallel
- Angles not (in general) preserved

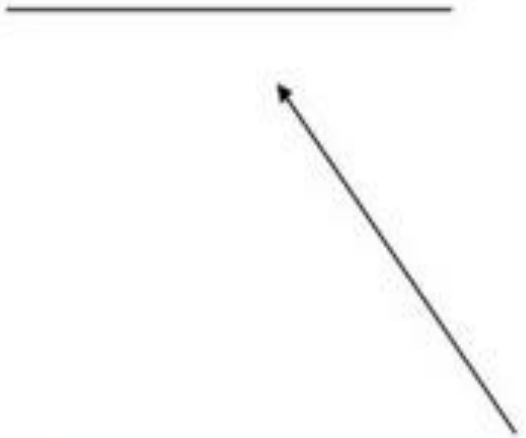
Parallel Projection

- Orthographic projection



when the projection is perpendicular to the view plane

Oblique projection



when the projection is not perpendicular to the view plane

Orthographic Projection

- Front, side and rear orthographic projection of an object are called **elevations** and the top orthographic projection is called **plan view**.
- all have projection plane perpendicular to a principle axes.
- Here length and angles are accurately depicted and measured from the drawing, so engineering and architectural drawings commonly employee this.

- However, As only one face of an object is shown, it can be hard to create a mental image of the object, even when several views are available.

Axonometric orthographic projections

- Orthographic projections that *show more than one face of an object* are called **axonometric** orthographic projections.
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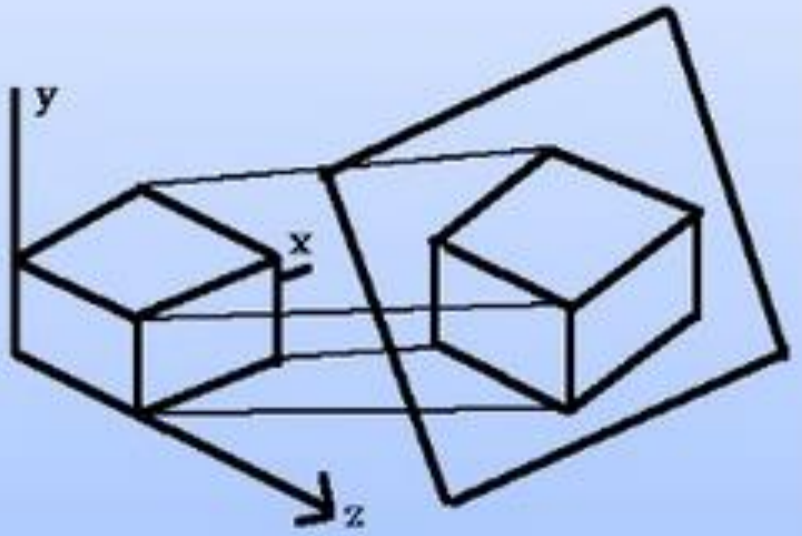
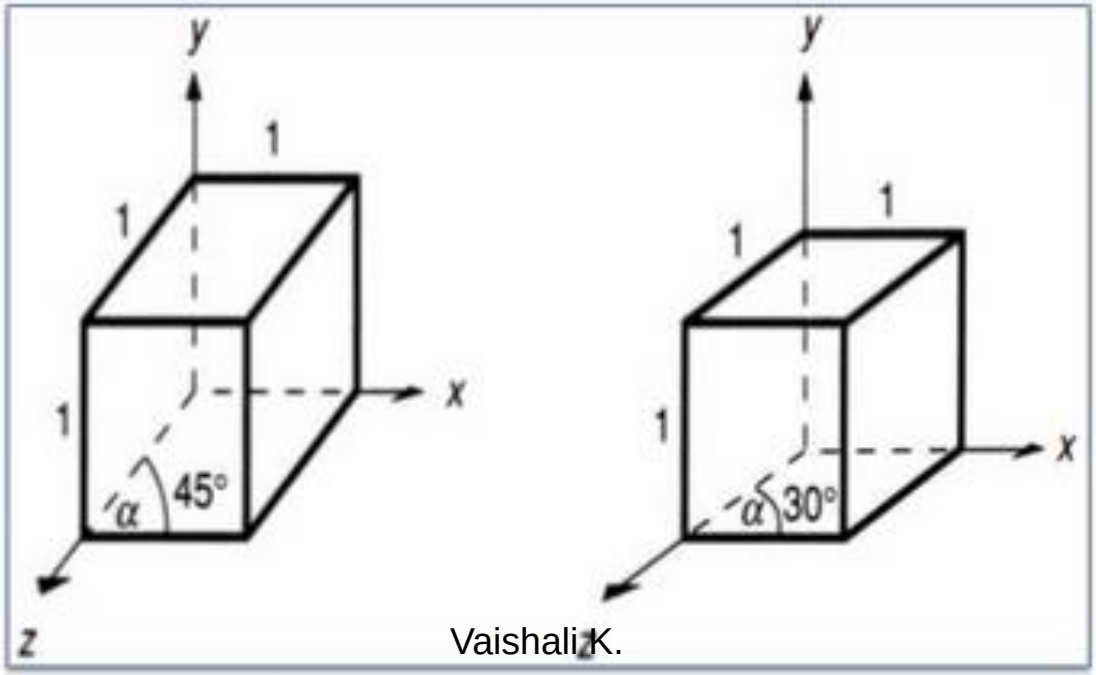
- The most common axonometric projection is an **isometric** projection where the projection plane intersects each coordinate axis in the model coordinate system at an equal distance.



- 2 common oblique parallel projections: *Cavalier* and *Cabinet*

Cavalier projection:

All lines perpendicular to the projection plane are projected with no change in length.



Cabinet projection:

- Lines which are perpendicular to the projection plane (viewing surface) are projected at 1 / 2 the length .
- This results in foreshortening of the z axis, and provides a more "realistic" view.