

# ***What is projection?***

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

## **2 types of projections**

*Perspective projection*

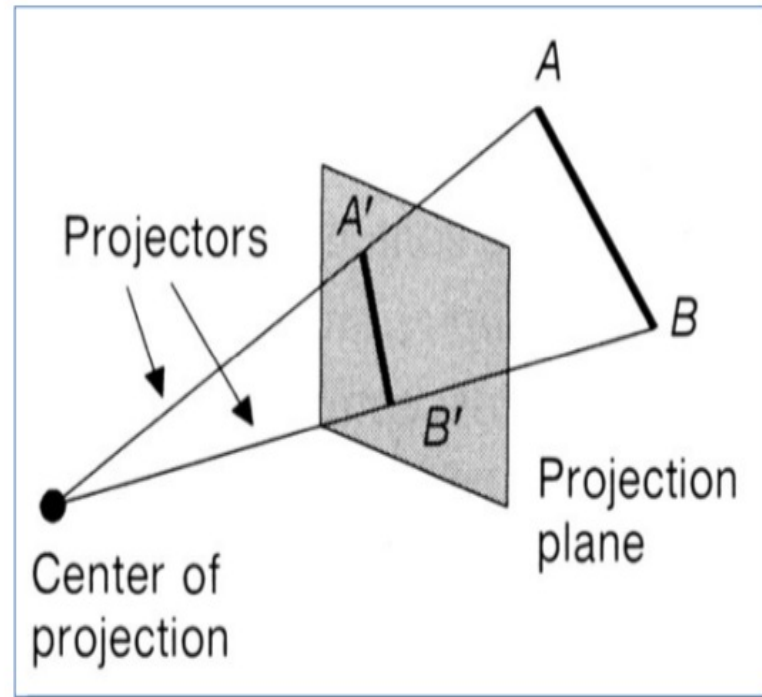
*Parallel projection*



# General Terms

- **Center of projection:** The point from where projection is taken. It can be either light source or eye.
- **Projection plane:** The plane on which projection of object is formed.
- **Projectors:** Line emerging from COP and hitting the projection plane. When projectors hit object and then hit projection plane the shadow of the object will be formed on projection plane.

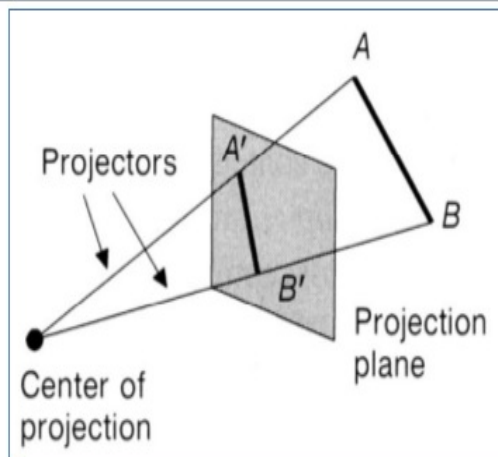
# Perspective Projection



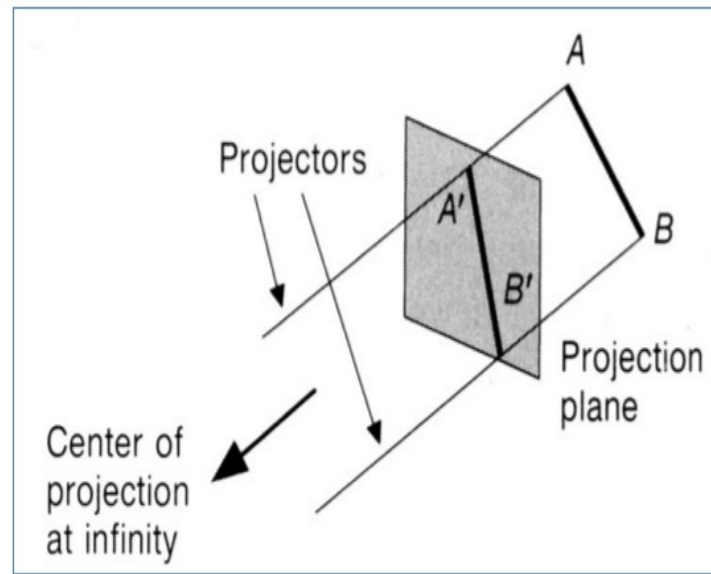
In **perspective projection**, object is transformed to the view plane along lines that converge to a point called **projection reference point (center of projection)**

# Characteristics of perspective projection

- Center of Projection (CP) is a finite distance from object
- Projectors are rays (i.e., non-parallel)
- Objects appear smaller as distance from CP (eye of observer) increases
- Most realistic.



## Parallel Projection



In **parallel projection**, coordinate positions are transformed to the view plane along parallel lines.





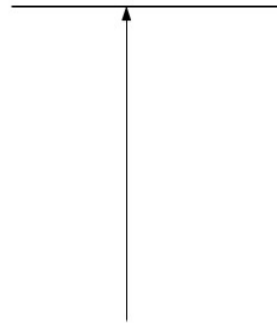
8 of 13



100%

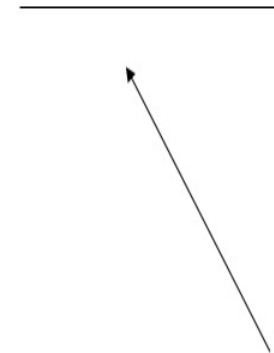


- Orthographic projection



when the projection is  
perpendicular to the view  
plane

## Oblique projection



when the projection is not  
perpendicular to the view  
plane



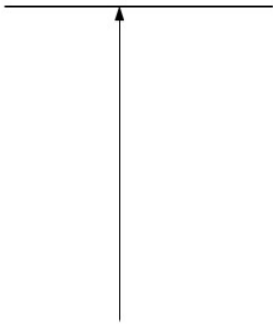
# Perspective v Parallel

- **Perspective:**
  - This type of projection is similar to human visual system...
  - In this system '**perspective foreshortening**' occur.
    - size of object varies inversely with distance from the center of projection. Projection of a distant object are smaller than the projection of objects of the same size that are closer to the projection plane.
- **Parallel:**
  - It preserves relative proportion of object.
  - less realistic view because of no foreshortening
  - however, parallel lines remain parallel.

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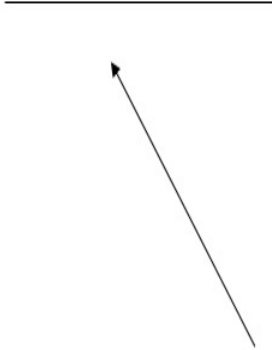
100%

- Orthographic projection



when the projection is perpendicular to the view plane

Oblique projection



when the projection is not perpendicular to the view plane

The diagram illustrates two types of projection. On the left, 'Orthographic projection' is shown with a horizontal line representing the view plane and a vertical arrow pointing upwards from a text box below, indicating a perpendicular projection. On the right, 'Oblique projection' is shown with a horizontal line representing the view plane and a diagonal arrow pointing upwards from a text box below, indicating a non-perpendicular projection.





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of 13



100%

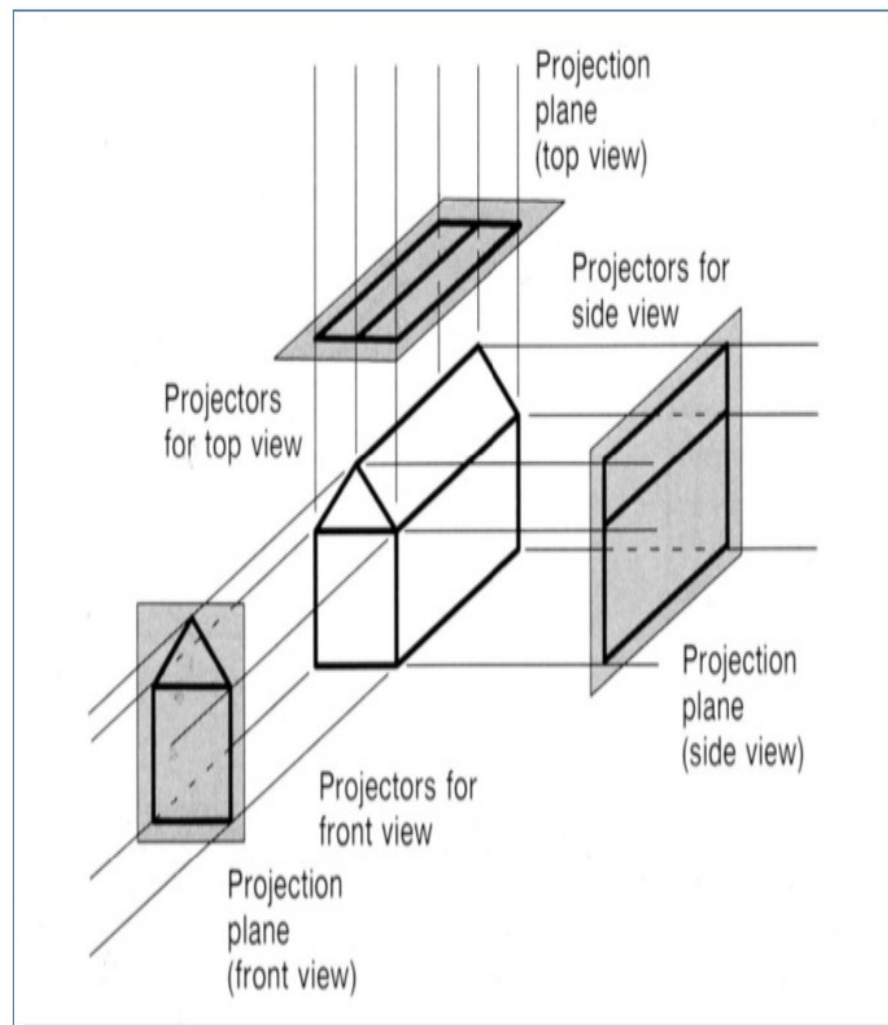


## Orthographic (or orthogonal) projections:

- Front, side and rear orthographic projection of an object are called **elevations**.
- all have projection plane perpendicular to a principle axes.
- This type of projection is used in architectural drawings .
- Different types of view can be shown by this type of projection.



## Orthogonal projections:



# Axonometric Projection

- Orthographic projections that show more than 1 side of an object are called **axonometric** orthographic projections
- In axonometric orthographic projections, the direction of projection is not parallel to any of the principal axis.

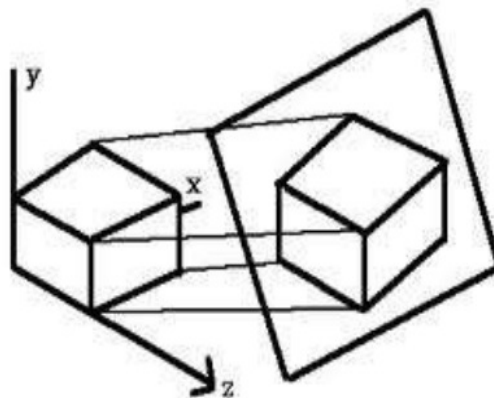


Continued.....

- Sub categories of Axonometric orthographic Projections are;
  1. Isometric
  2. Di-metric
  3. Trimetric

## Continued.....

- Isometric Projection: The direction of projection makes equal angles with all of the principal axis.





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125%



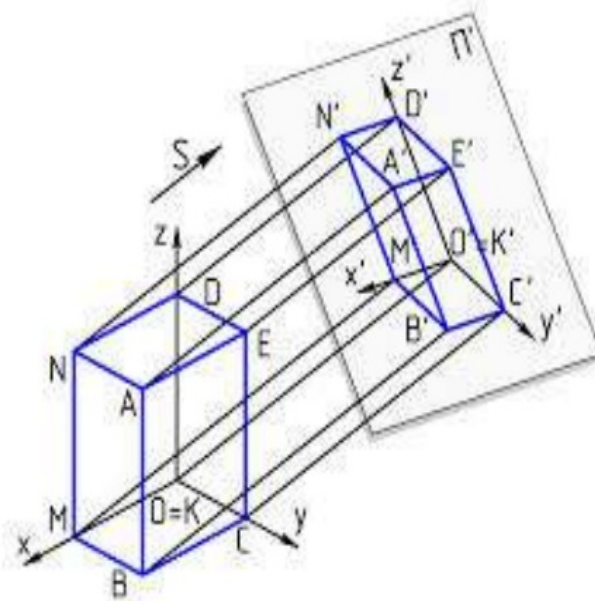
## Continued.....

- Di-metric Projection: The direction of projection makes equal angles with exactly two of the principal axis.



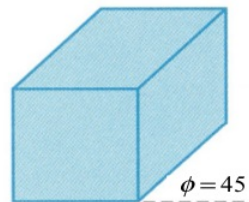
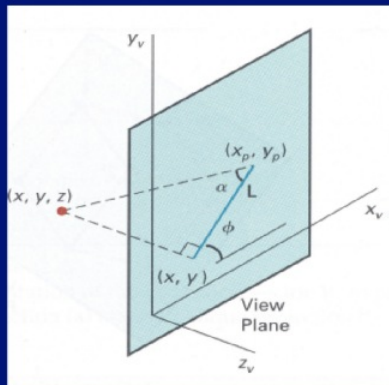
## Continued....

- Trimetric Projection: The direction of Projection makes unequal angles with the principal axis.

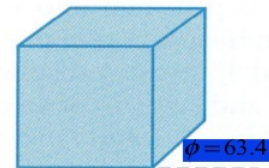


# Oblique Projections

*DOP not perpendicular to view plane*



Cavalier  
(DOP  $\alpha = 45^\circ$ )  
 $\tan(\alpha) = 1$



Cabinet  
(DOP  $\alpha = 63.4^\circ$ )  
 $\tan(\alpha) = 2$

H&B



# Perspective v Parallel

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  - however, parallel lines remain parallel.





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117.65%

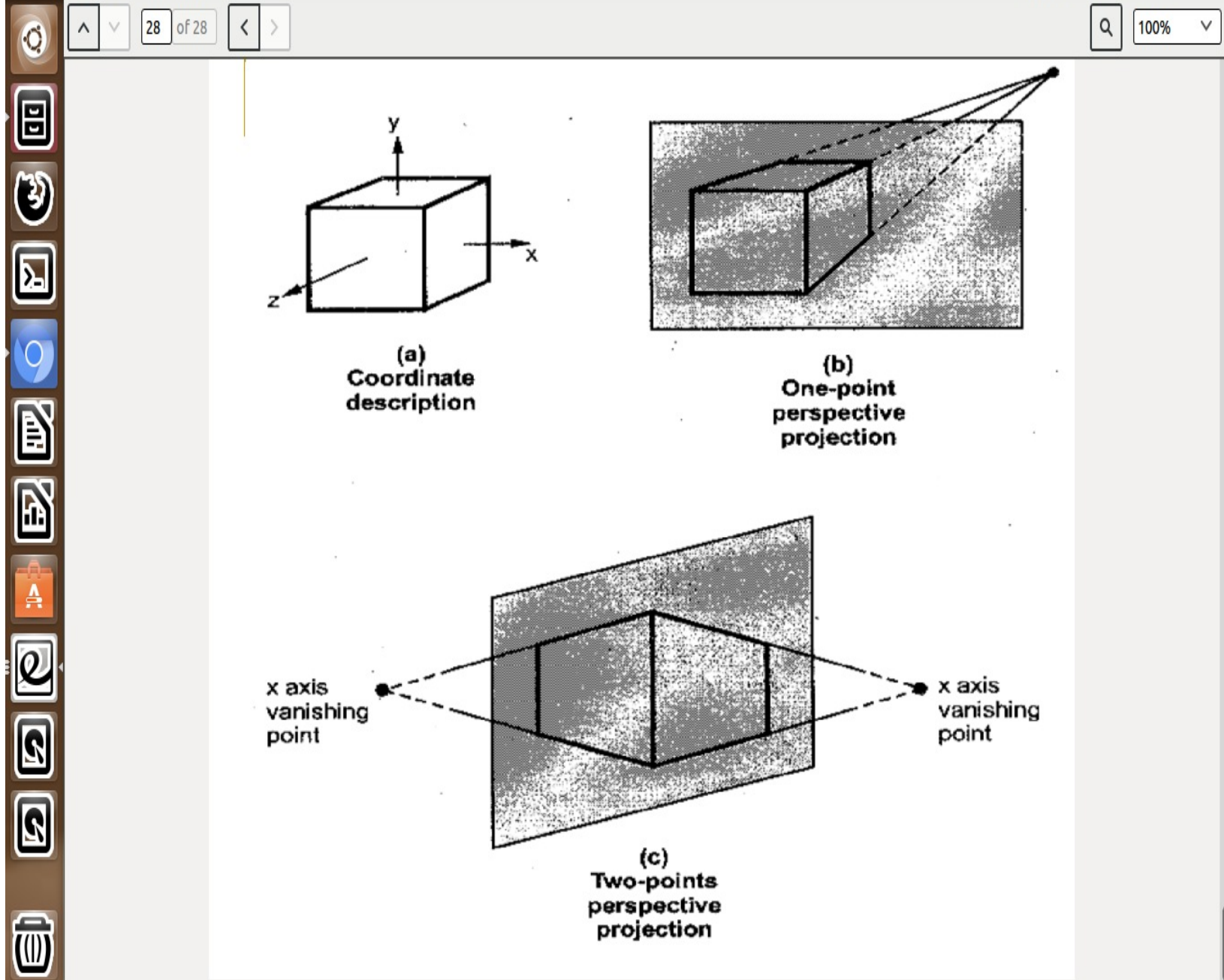
# Road in perspective





# Types of Perspective Projection

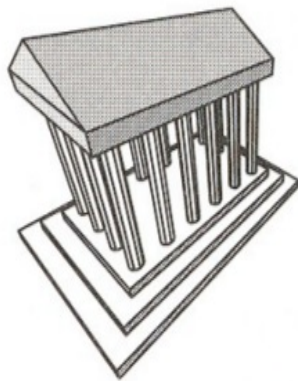
- The perspective projection of any set of parallel lines that are not parallel to the projection plane converge to a **vanishing point**.
- The vanishing point for any set of lines that are parallel to one of the three principle axes of an object is referred to as a **principle vanishing point or axis vanishing point**.
- There are at most three such points, corresponding to the number of principle axes cut by the projection plane.
- The perspective projection is classified according to number of principle vanishing points in a projection:
  - one-point,
  - two-points or
  - three-points projections.



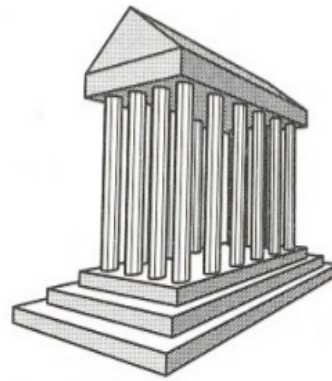


# Perspective Projection

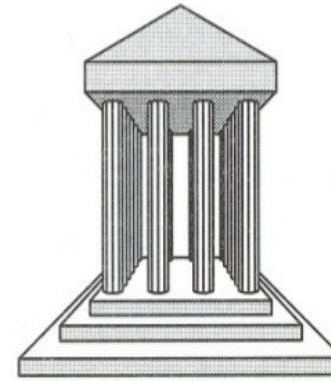
*How many vanishing points?*



3-Point  
Perspective



2-Point  
Perspective



1-Point  
Perspective