CSO 351 : COMPUTER GRAPHICS

ASSIGNMENT - 4

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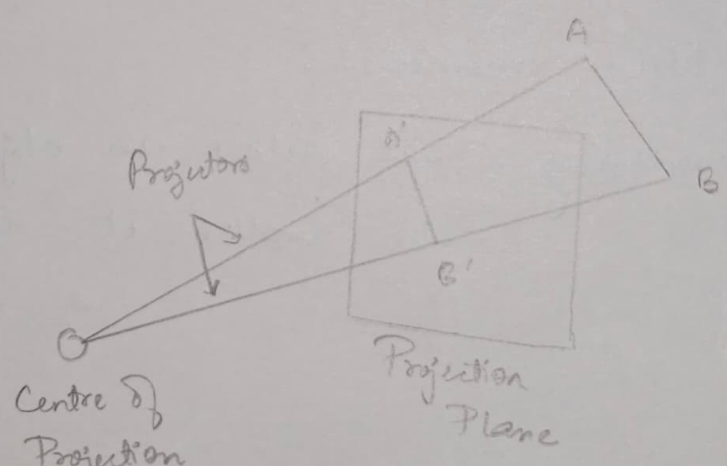
1. Perspective Projections :

→ Visual effect is similar to human visual system.

→ Has 'perspective foreshortening' means size of object varies inversely with distance from the centre of projection.

→ Parallel lines do not in general project to parallel lines.

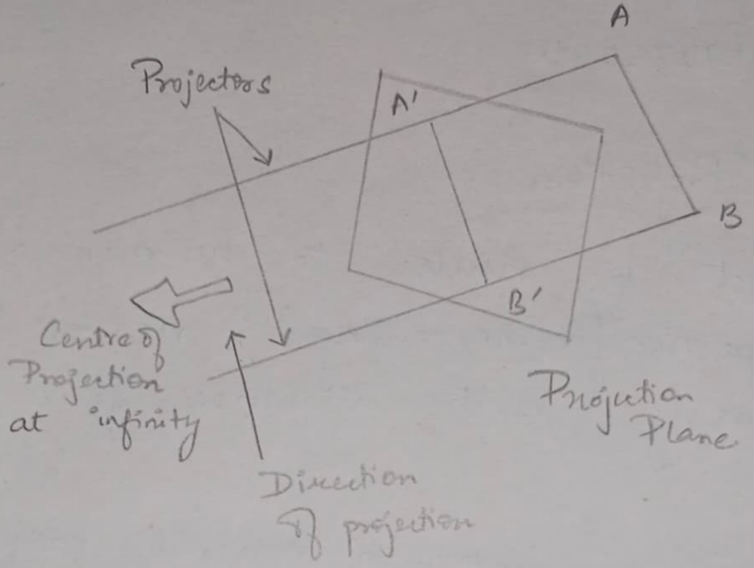
→ Angles only remain intact for faces parallel to projection plane.



Perspective Projection

> Parallel Projection :

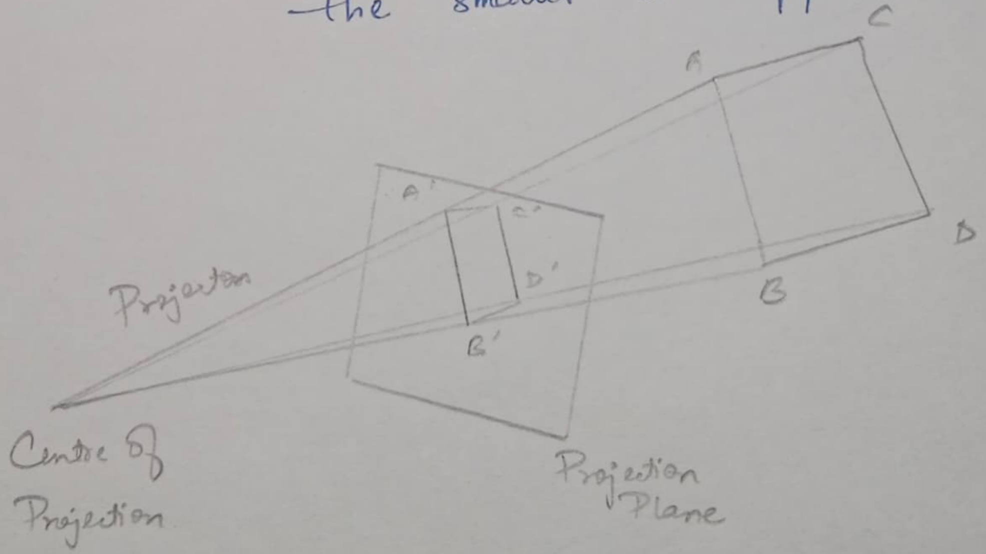
→ Less realistic view because of no foreshortening.
→ Parallel lines remain parallel.
→ Angles only remain intact for faces parallel to projection plane.



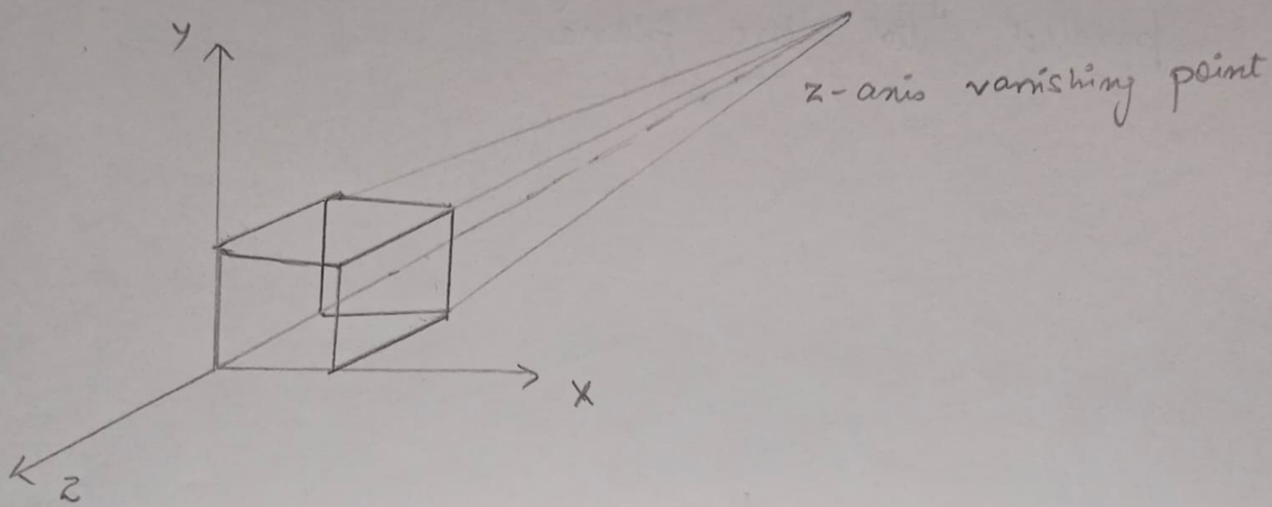
Parallel Projection

> Perspective projection – anomalies :

- Perspective foreshortening > The farther an object is from COP the smaller it appears.

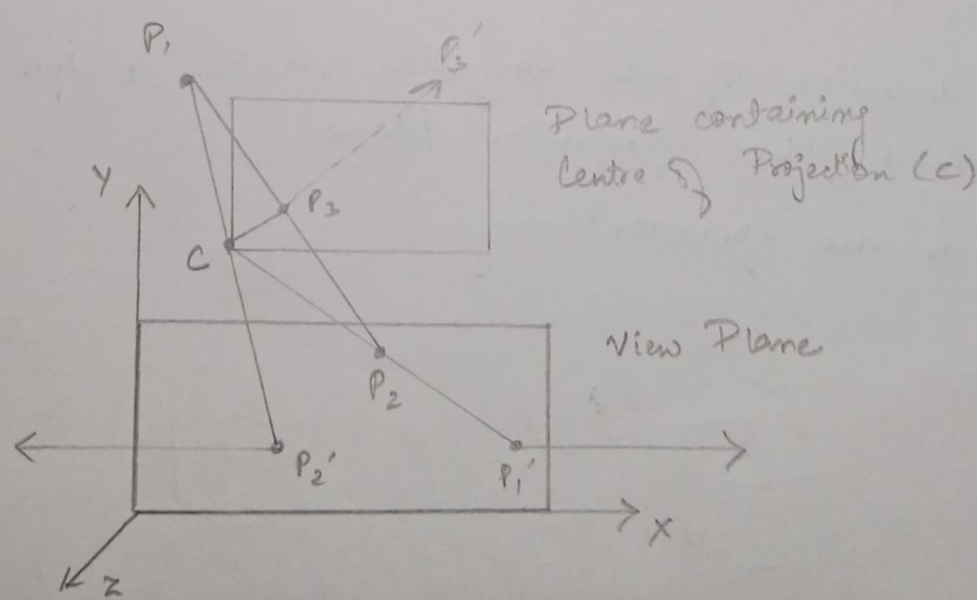


- Vanishing Points > Any set of parallel lines not parallel to the view plane appear to meet at some point.
  - There are infinite number of these, 1 for each of the infinite amount of directions line can be oriented.



- View Confusion > Objects behind the COP are projected upside down and backward onto the view - plane.

- Topological distortion > A line segment joining a point which lies in front of viewer to a point in back of the viewer is projected to a broken line of infinite extent.

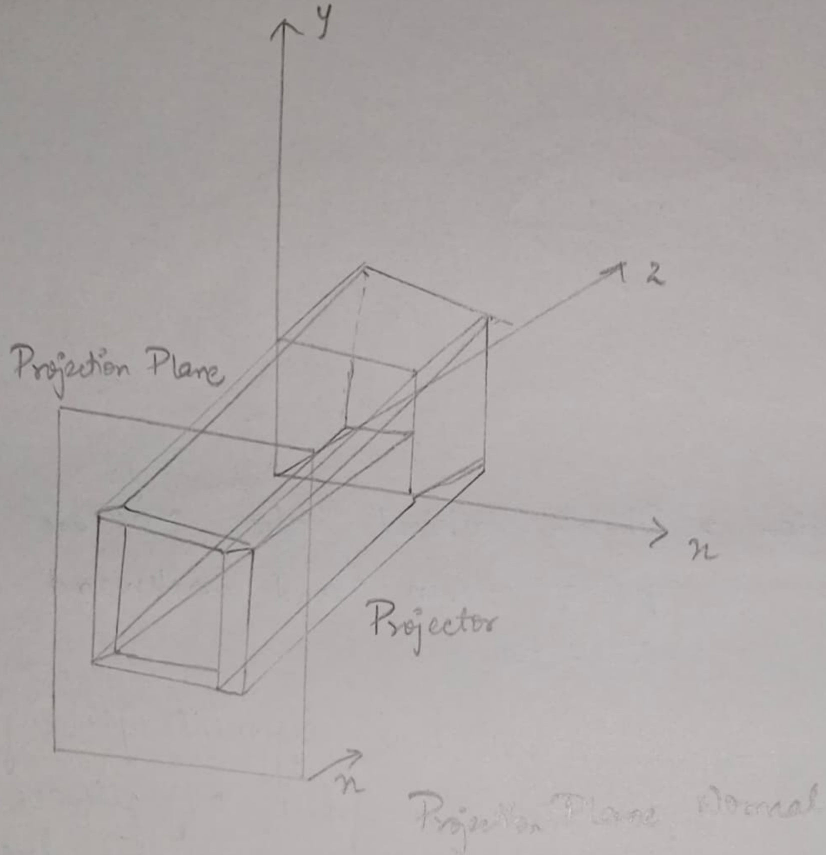


4. Oblique Parallel Projection

→ Objects can be visualized better then with orthographic projections.

→ Can measure distances, but not angles.

* can only measure angles for faces of objects parallel to the plane.

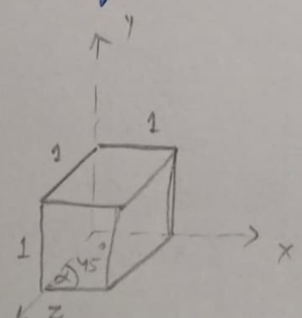


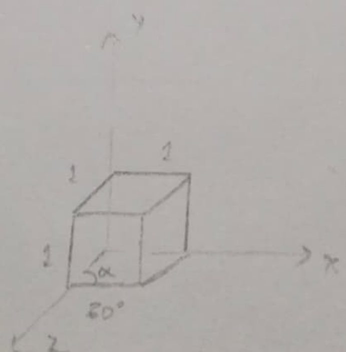
→ 2 common oblique parallel projections :-

i) Cavalier

→ The direction of the projection makes a 45 degree angle with the projection plane.

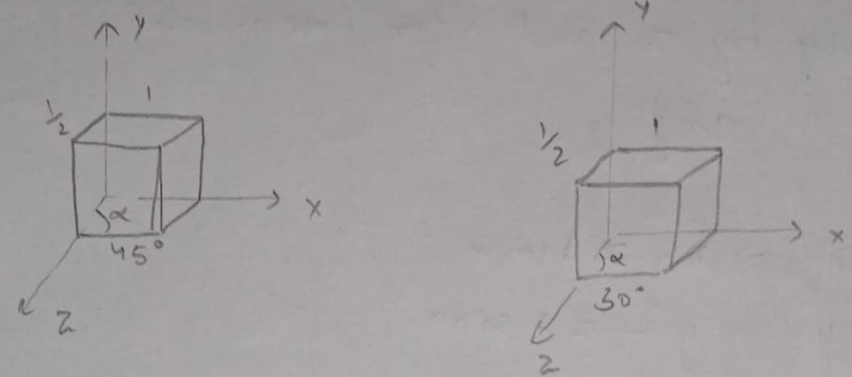
→ There is no foreshortening.





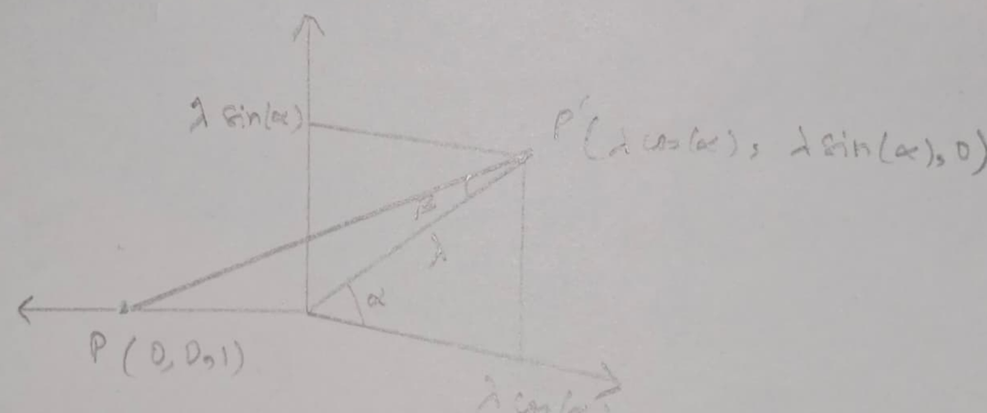
ii) Cabinet

→ The direction of the projection makes a 63.4 degree angle with the projection plane. This results in foreshortening of the z-axis, and provides a more "realistic" view.



> Cavalier, cabinet and orthogonal projections can all be specified in terms of (α, β) or (α, λ) since

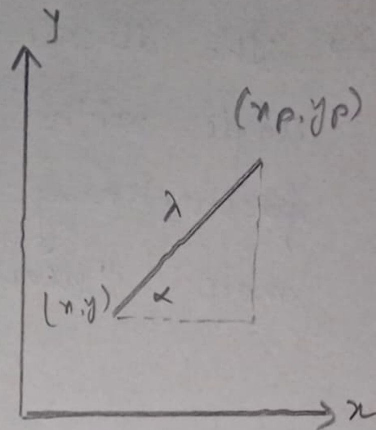
- $\tan(\beta) = 1/\lambda$



$\lambda = 1$	$\beta = 45$	Cavalier Projection	$\alpha = 0 - 360$
$\lambda = 0.5$	$\beta = 63.4$	Cabinet Projection	$\alpha = 0 - 360$
$\lambda = 0$	$\beta = 90$	Orthogonal Projection	$\alpha - 360$

$PP' = (\lambda\cos(\alpha), \lambda\sin(\alpha) - 1) = DOP$

$Proj(P) = (\lambda\cos(\alpha), \lambda\sin(\alpha), 0)$



$\therefore x_p = x + \lambda\cos\alpha$

$y_p = y + \lambda\sin\alpha$

Generally,

→ multiply by z and allow for (non-zero) x and y

$$x' = x + z\lambda\cos\alpha$$

$$y' = y + z\lambda\sin\alpha$$

$$\begin{pmatrix} x' \\ y' \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & \lambda\cos\alpha & 0 \\ 0 & 1 & \lambda\sin\alpha & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$