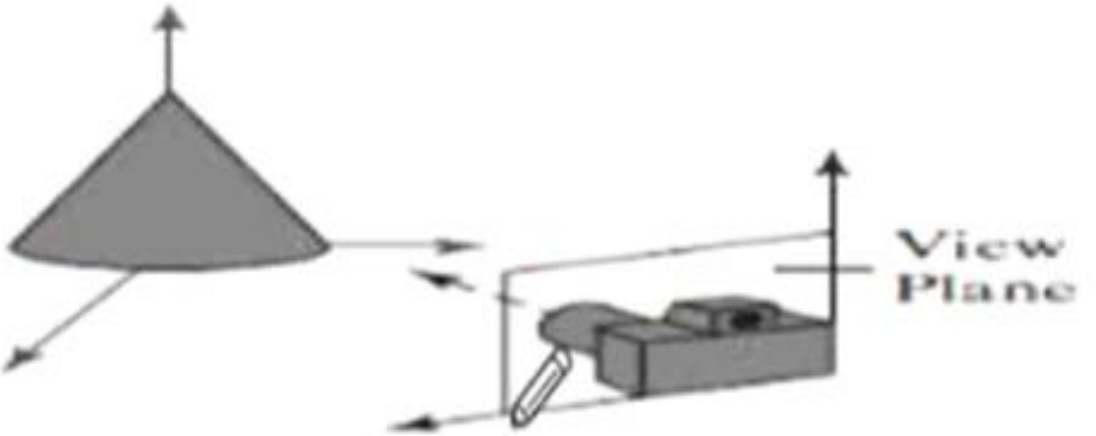
3D Viewing and 3D Viewing Pipeline

Overview of 3D Viewing

- Three-dimensional viewing involves some tasks that are not present in two-dimensional viewing.
- For example, projection routines are needed to transfer the scene to a view on a planar surface, visible parts of a scene must be identified
- For a realistic display, lighting effects and surface characteristics must be taken into account.
- To obtain a display of a three-dimensional world-coordinate scene, we first set up a coordinate reference for the viewing, or "camera," parameters.
- This coordinate reference defines the position and orientation for a view plane (or projection plane) that corresponds to a camera film plane.

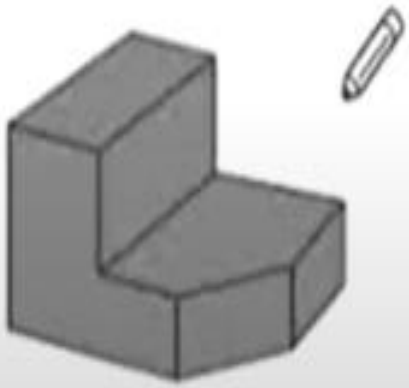
Overview of 3D Viewing

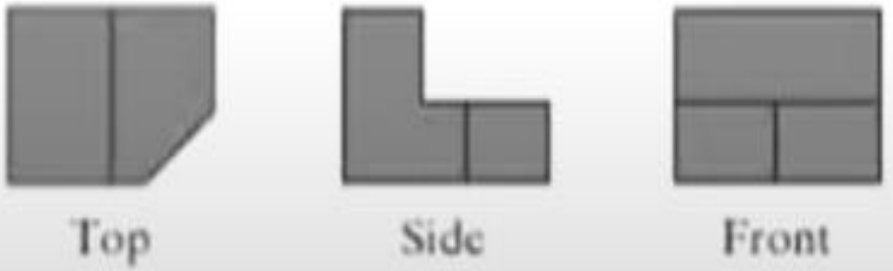


- Object descriptions are then transferred to the viewing reference coordinates and projected onto the view plane.
- We can generate a view of an object on the output device in wireframe (outline) form
- We can apply lighting and surface-rendering techniques to obtain a realistic shading of the visible surfaces.

Projections

- Unlike a camera picture, we can choose different methods for projecting a scene onto the view plane.
- One method for getting the description of a solid object onto a view plane is to project points on the object surface along parallel lines.
- This technique, called *parallel projection,* is used in engineering and architectural drawings to represent an object with a set of views that show accurate dimensions of the object.



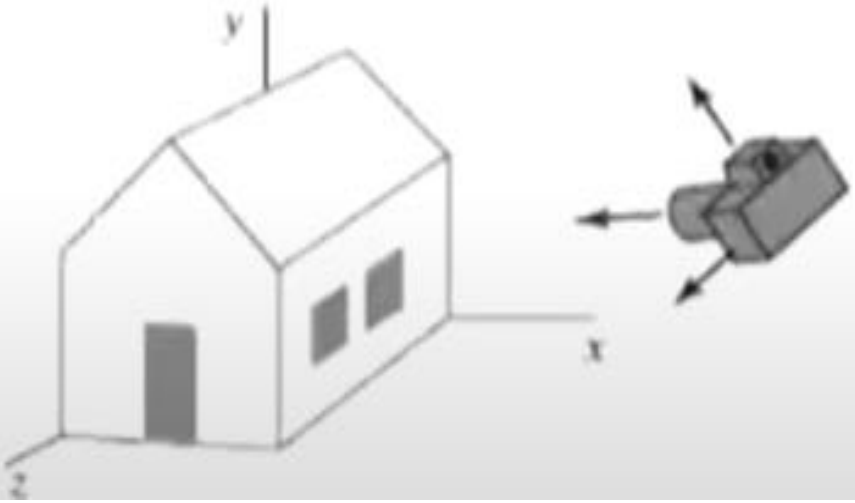


Projections

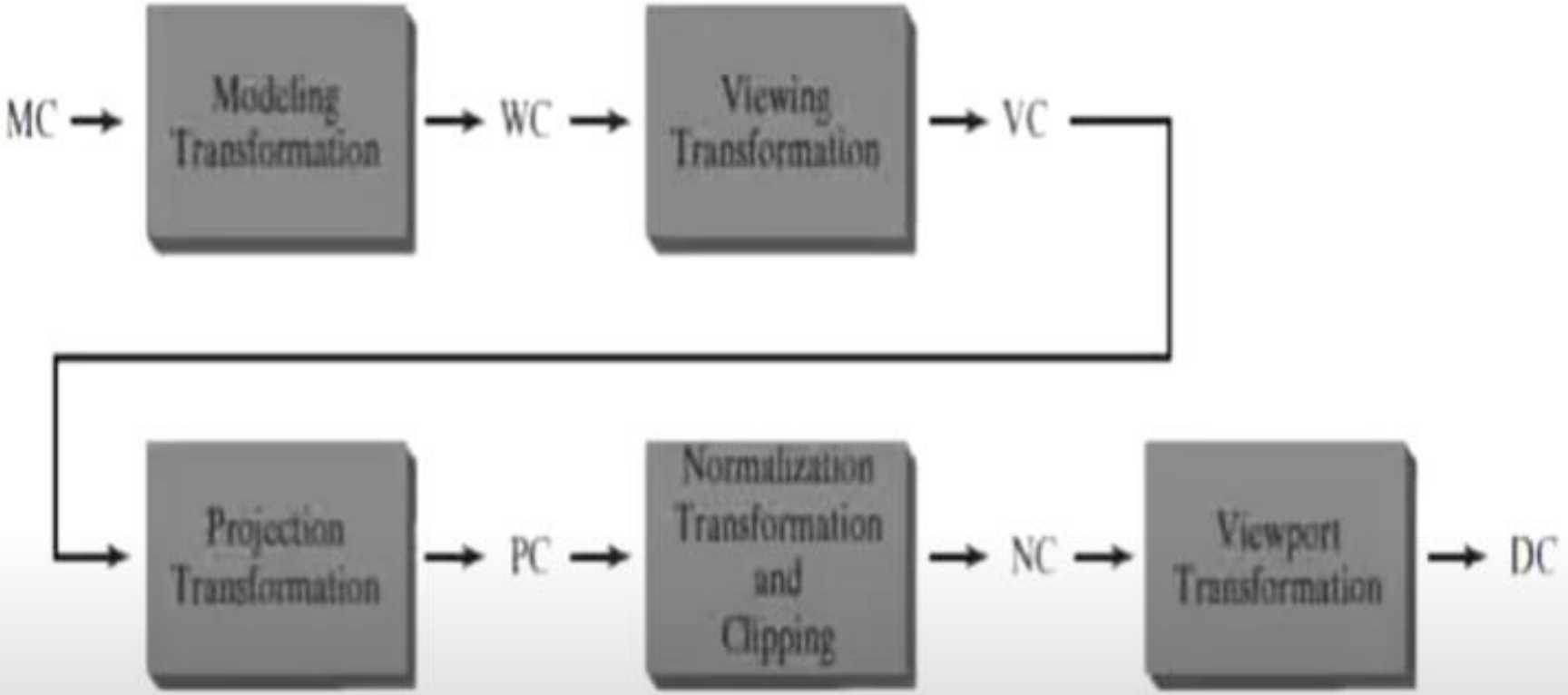
- Another method for generating a view of a three-dimensional scene is to project points to the view plane along converging paths.
- This process, called a *perspective projection,* causes objects farther from the viewing position to be displayed smaller than objects of the same size that are nearer to the viewing position.
- A scene that is generated using a perspective projection appears more realistic, because this is the way that our eyes and a camera lens form images.

3D Viewing Pipeline

- We need to choose a viewing position corresponding to where we would place a camera.
- We choose the viewing position according to whether we want to display a front, back, side, top, or bottom view of the scene.
- Then we must decide on the camera orientation.



3D Viewing Pipeline



- **Modeling Coordinates :** Construct shape of 3D Objects (Place)
- **Modeling Transformation :** Decide on dimensions to capture in 3D scene(Arrange)
- **World Coordinates :** Output as a scene after Modeling Transformation

- **Viewing Transformation :** Position and orientation of Camera
- **Viewing Coordinates :** Output of Viewing transformation as Camera Coordinates

- **Projection Transformation :** Viewing coordinate description to Projection Plane by adjusting focusing of camera and direction of light to form an image on camera film. It's a 3D to 2D transformation.

- **Normalized transformation & clipping :** To be used with any device
- **Viewport transformations :** Window to viewport transformation ; on clicking camera button

3D Viewing Pipeline

- In three-dimensional viewing, the clipping window is positioned on a selected view plane, and scenes are clipped against an enclosing volume of space, which is defined by a set of *clipping planes*.
- The viewing position, view plane, clipping window, and clipping planes are all specified within the viewing-coordinate reference frame.
- A two-dimensional clipping window, corresponding to a selected camera lens, is defined on the projection plane, and a three-dimensional clipping region is established.
- This clipping region is called the view volume, and its shape and size depends on the dimensions of the clipping window, the type of projection we choose, and the selected limiting positions along the viewing direction