SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107
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Department of Information Technology & Artificial Intelligence & Data Science

Course Name – 19AD512 COMPUTER GRAPHICS

III Year / V Semester

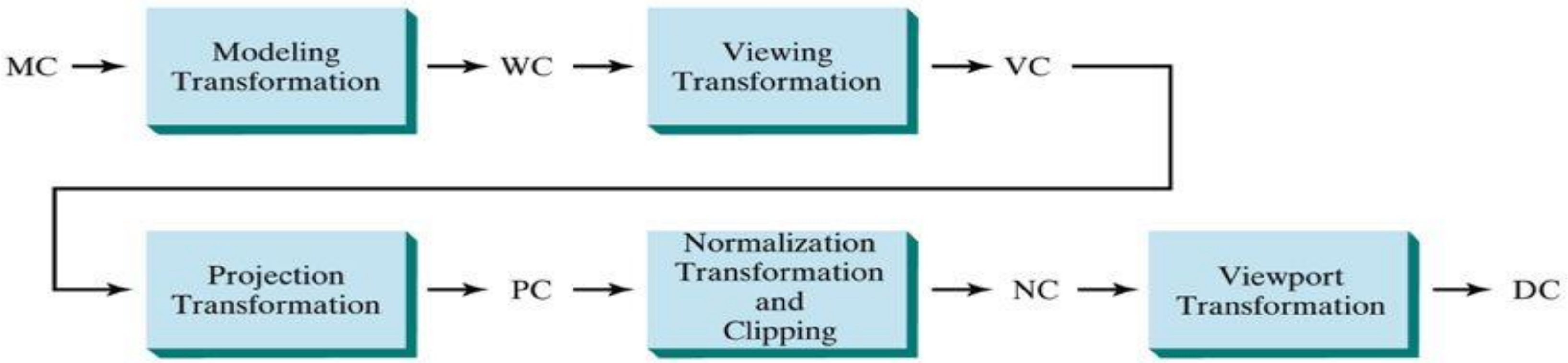
Unit 2 – VIEWING AND VISUAL REALISM

Topic –THREE DIMENSIONAL VIEWING

DEFINE THREE DIMENSIONAL VIEWING?

- Our eyes collapse 3D world to 2D retinal image(Brain then has to reconstruct 3D)
- In computer graphics, 3D viewing is the process of creating and manipulating three-dimensional objects and scenes.
- This allows for more realistic and immersive experiences in video games, movies, and other forms of media. In Computer Graphics ,this process occurs by projection.
- In computer graphics, 3D viewing refers to the process of representing and rendering three-dimensional objects on a two-dimensional screen

General 3D Viewing Pipeline



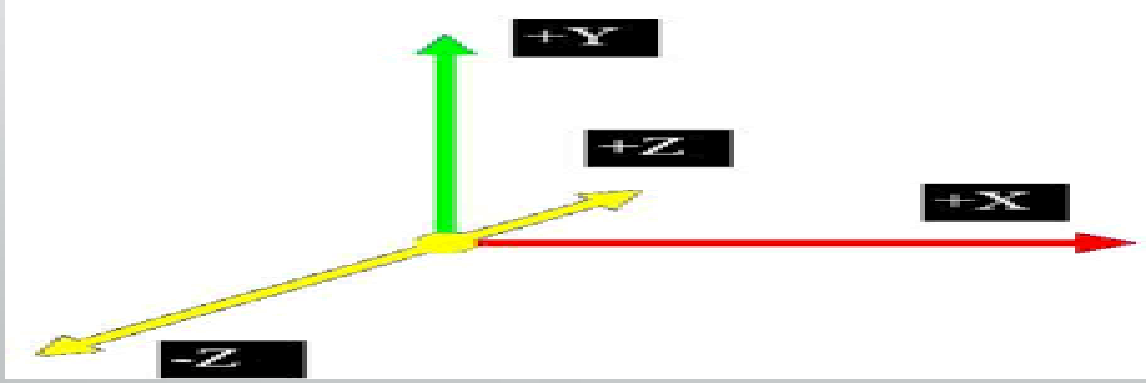
- Modeling coordinates (MC)
- World coordinates (WC)
- Viewing coordinates (VC)
- Projection coordinates (PC)
- Normalized coordinates (NC)
- Device coordinates (DC)

Processing Steps

- Once the scene has been model, world coordinates position is converted to viewing coordinates.
- The viewing coordinates system is used in graphics packages as a reference for specifying the observer viewing position and the position of the projection plane.
- Projection operations are performed to convert the viewing coordinate description of the scene to coordinate positions on the projection plane, which will then be mapped to the output device.
- Objects outside the viewing limits are clipped from further consideration, and the remaining objects are processed through visible surface identification and surface rendering procedures to produce the display within the device viewport.

THREE DIMENSIONAL COORDINATE SYSTEMS

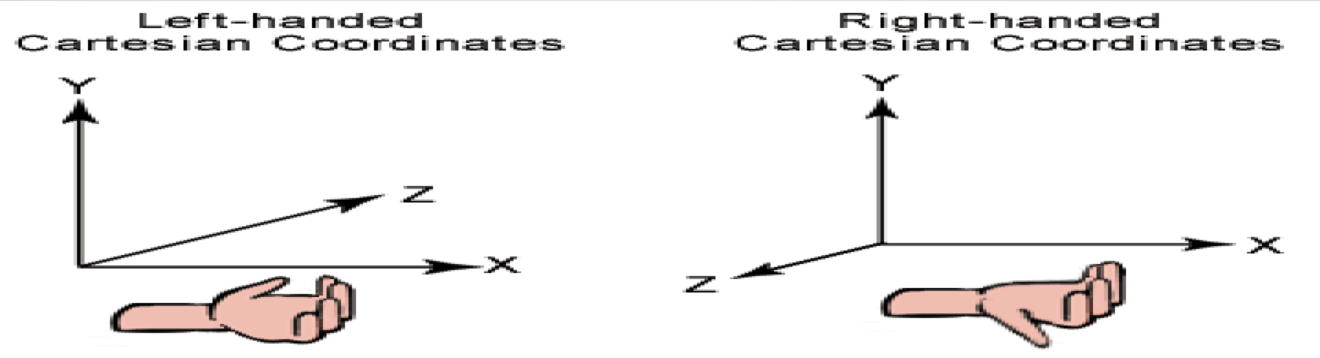
- Explanation of 3D space using X, Y, and Z axes: In a 3D coordinate system, objects are located in a three-dimensional space defined by the X, Y, and Z axes.
- This allows for specifying the position of objects in three dimensions.- Introduction to the Cartesian coordinate system: The Cartesian coordinate system is a common method for representing 3D space, where each point is defined by its X, Y, and Z coordinates.



Types Cartesian coordinate system

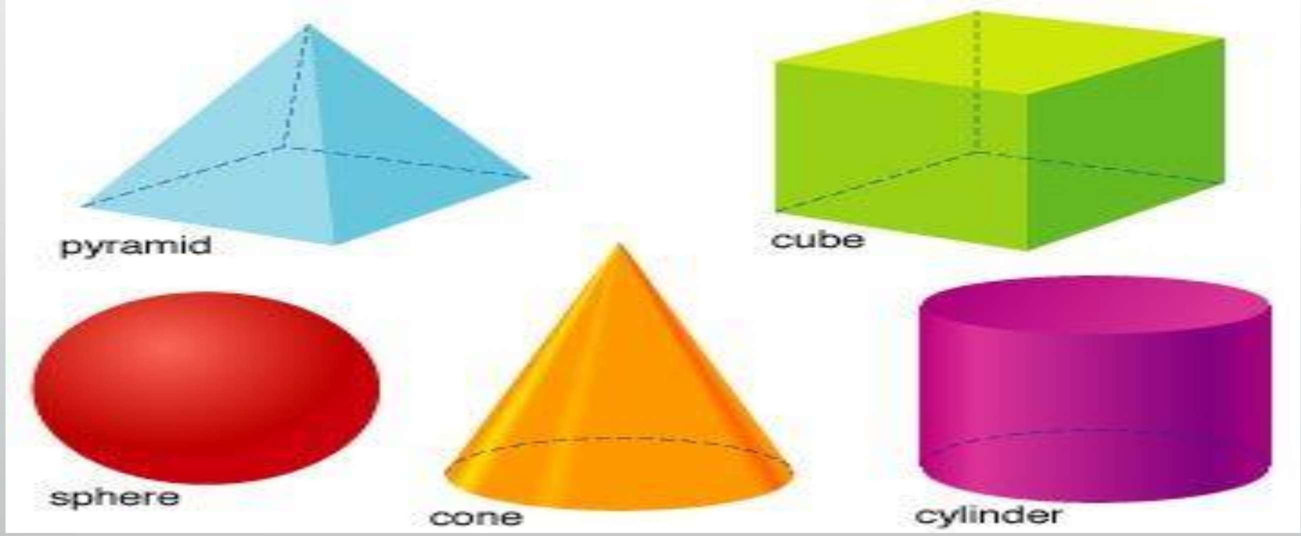
The two possible coordinate systems which result are called 'right-handed' and 'left-handed'.

- The standard orientation, where the *xy*-plane is horizontal and the *z*-axis points up (and the *x*- and the *y*-axis form a positively oriented two-dimensional coordinate system in the *xy*-plane if observed from *above* the *xy*-plane) is called **right-handed** or **positive**.
- The thumb indicates the *x*-axis, the index finger the *y*-axis and the middle finger the *z*-axis. Conversely, if the same is done with the **left hand,** a left-handed system results.



3D OBJECTS

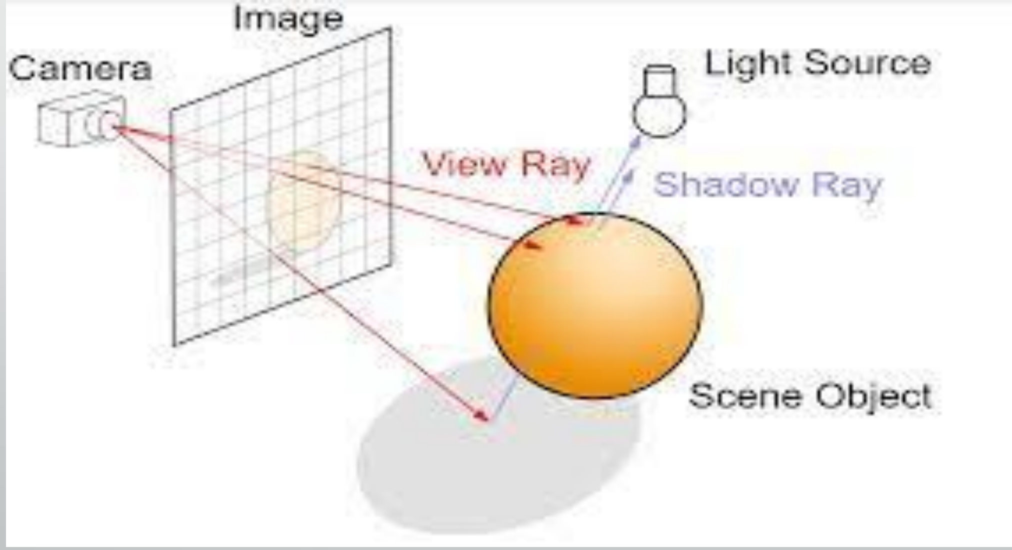
Briefly describe 3D objects such as points, lines, and polygons: In 3D graphics, objects can take various forms, from simple points and lines to more complex structures like polygons (e.g., triangles and quads), which are used to create surfaces and shapes.



CAMERA PERSPECTION

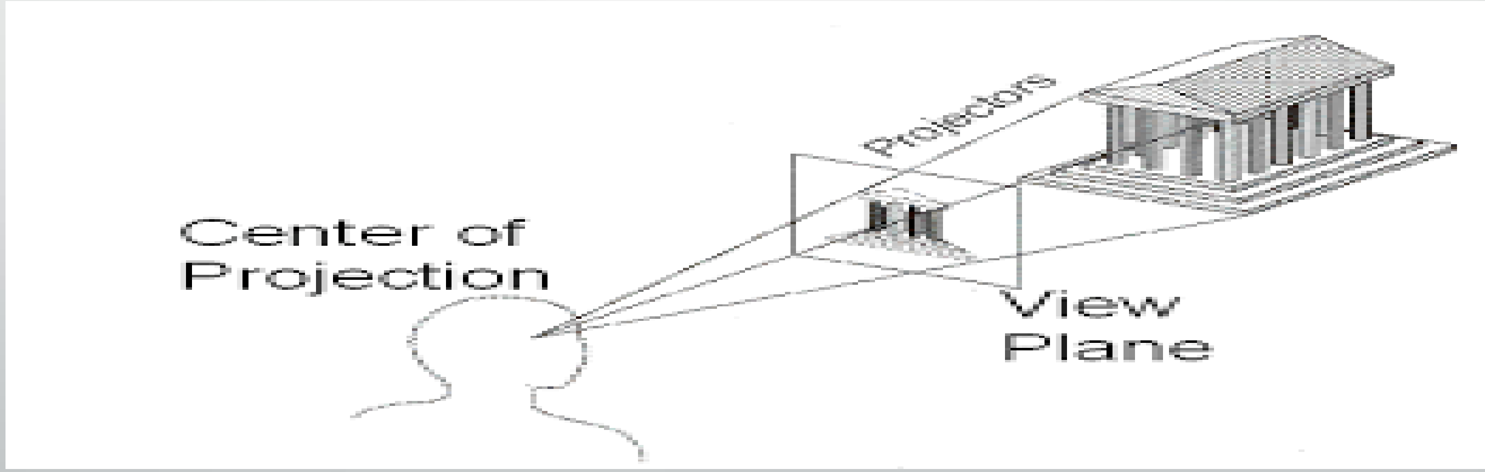
In computer graphics, a virtual camera is used to simulate how a real-world camera captures scenes. It defines the viewpoint and orientation of the observer.

The viewing frustum is a pyramid-shaped volume that represents what the camera can see. It consists of a near plane, a far plane, and two side planes.



PERSPECTIVE PROJECTION

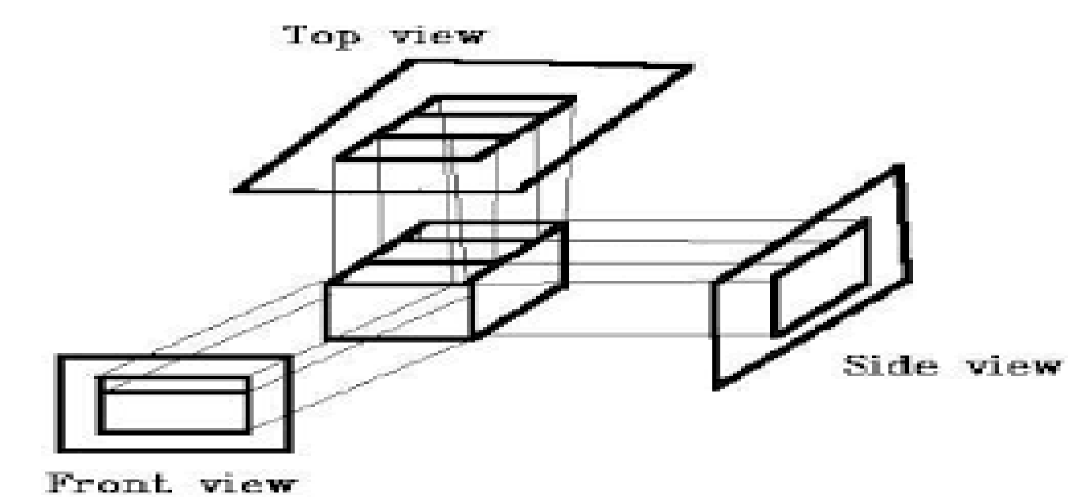
- Perspective projection is a method used to create the illusion of depth in 3D graphics by making objects appear smaller as they move farther from the camera.
- The projection matrix is a mathematical transformation that maps 3D coordinates to 2D coordinates on the screen, accounting for perspective effects.



ORTHOGRAPHIC PROJECTION

Orthographic projection is another projection method that does not create depth effects but is useful for engineering and architectural graphics where accurate measurements are needed(Like Top,Front,Side Views)

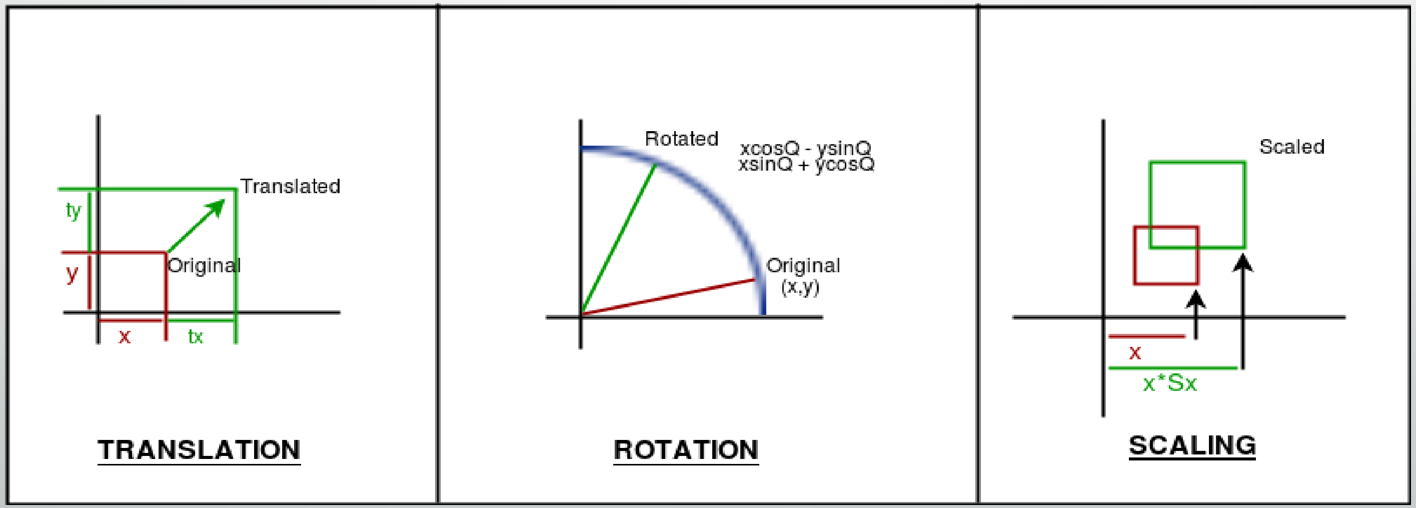
Orthographic projection is often used in technical drawings and architectural plans.



VIEWING TRANSFORMATION

Viewing transformations involve operations like rotation, translation, and scaling to position and orient objects within the viewing frustum.

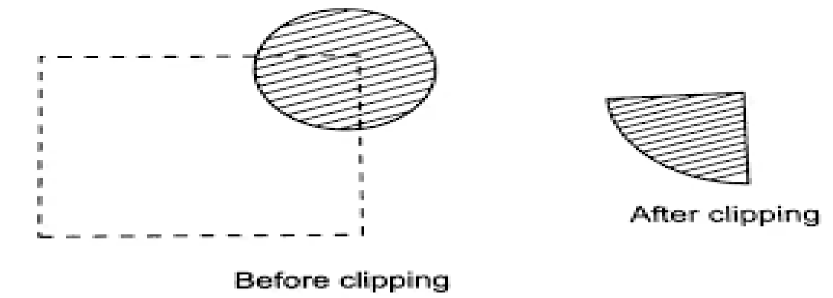
These are common operations to manipulate the position, orientation, and size of 3D objects.

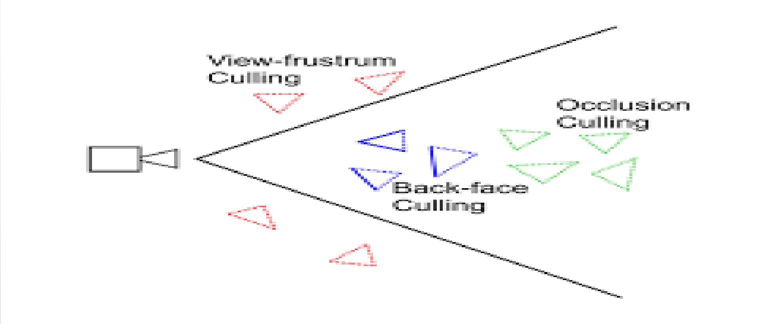


CLIPPING AND CULLING

Clipping and culling are techniques used to remove objects that are not within the viewing frustum, saving computational resources.

Objects that are too close (near plane) or too far (far plane) from the camera may be clipped or removed from the view.

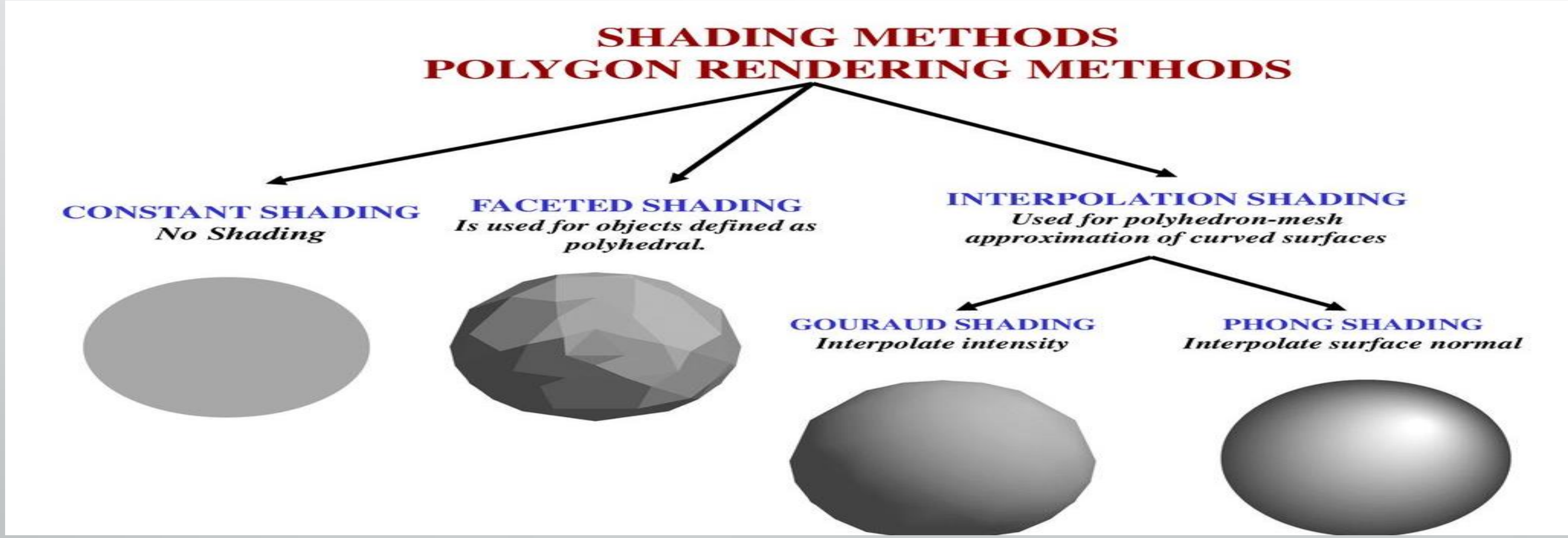




RENDERING TECHNIQUES

Shading models determine how light interacts with surfaces in a 3D scene. Gouraud and Phong shading are methods for calculating lighting effects.

Hidden surface removal techniques determine which parts of objects are visible, ensuring that only the visible surfaces are rendered.



3D VIEWING IN APPLICATIONS

3D viewing is a fundamental component of applications like video games, simulations, and animated movies, allowing for immersive and realistic experiences.

THANK YOU