Lecture 6: Projections

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1 Viewing Systems

In real life we pick up objects, position them and then view them. In computer graphics objects are positioned in a fixed frame. The viewer moves to the appropriate position in order to achieve the desired view.

2 Perspective Projections

We assume that there exists a *Centre of Projection* (COP). Objects' distances from the **COP** cause the objects to appear larger or smaller on the intersecting viewplane.

Lines that are not parallel to the viewplane converge to a vanishing point. The *Principal Vanishing Point* exists for lines that are parallel to the principal axis. This can be clearly seen in the perspective projection of a cube, edges which are parallel to one another appear to converge.

3 Parallel/Orthographic Projections

Here the COP is **always** at infinity. This means that the viewplane is aligned with the axes and the *Direction of Projection* (DOP)

4 View Reference Coordinate System

4.1 Viewing Parameters

- Location of viewplane
- Window within viewplane
- Projection type
- Projection reference point (**prp**)

4.2 Viewplane Parameters

- View Reference Point (**vrp**)
- Viewplane Normal (**vpn**)
- View Up Vector (**vup**)

4.3 Window Parameters

- Width — u_{min} and u_{max}
- Height — v_{min} and v_{max}

4.4 Coordinate System in Different Projections

For **Perspective Projections** there is only one property:

- **prp** becomes **cop**

In **Parallel Projections** there are three properties:

- **cw** — The center of window
- **dop** — Direction of projection (**cw** – **prp**)
- The projection is *Orthographic* if **dop** and **vpn** are parallel

5 View Volumes for Graphics

The view volume for perspective projections is a truncated pyramid (frustrum) while the view volume for parallel perspective projections is a cuboid. The view volumes define a specific region of the scene which is viewed in the current image. The view volume is defined by the clipping planes, the projection rays used by the projection system and by the image rectangle. They are sometimes used in graphics for visualisation such as creating smoke or mist defined only in a specific region of the scene.