Space Visualizations

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February 8, 2025

1 Introduction

This document is not real.

2 Camera3D

A Camera3D represents a viewer in 3D space, with a focal length to the view plane. The main function of a Camera3D is to convert from a point in world view to a 2D point on the view plane.

- x

- y

- z

- pitch (angle 1): θ

- roll (angle 2): ϕ

- yaw (angle 3): γ

- focal length: f

3 Transform Idea

Keep track of how the camera moves with user input, and use this to convert world points to view plane points.

Taking $f > 0$ and all other values 0 to correspond to the camera facing down the positive z-axis, with x and y axes normalized, placed at $(0, 0, 0)$ with view plane centered at $(0, 0, f)$ camera coordinates, parallel to the xy-plane. So the view

How to convert from (x, y, z) in the world to (X, Y) on the screen?

```
StdDraw.point(xClip, yClip)
```

$$worldPoint = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

$$T(worldPoint) = \begin{pmatrix} \text{xClip} \\ \text{yClip} \end{pmatrix}$$

Find T that converts from world coordinates to clipping coodinates.

$$T : WorldSpace \longrightarrow CameraSpace \longrightarrow ClipSpace$$

Figure out which way to apply the transformations from in matrices.