Space Visualizations

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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 3D world view to a 2D point on the view plane. The camer3D has seven parameters:

- x: camera x-coordinate
- y: camera y-coordinate
- z: camera z-coordinate
- θ: pitch (angle 1)
- ϕ: roll (angle 2)
- γ: yaw (angle 3)
- f: focal length

3 Transform Idea

Keep track of how the camera moves with user input, and use this to convert world points to view plane points. `StdDraw.point(xClip, yClip)`

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

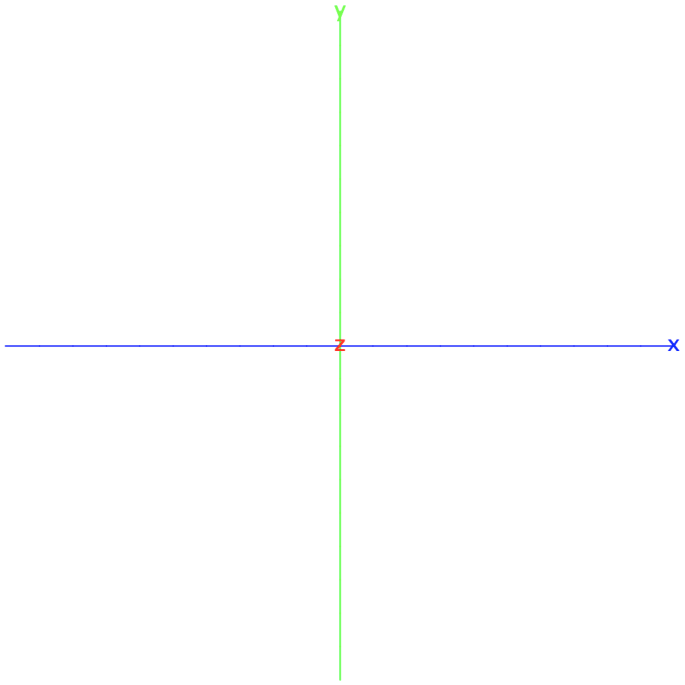
$$T(worldPoint) = \begin{pmatrix} \text{xClip} \\ \text{yClip} \end{pmatrix}$$

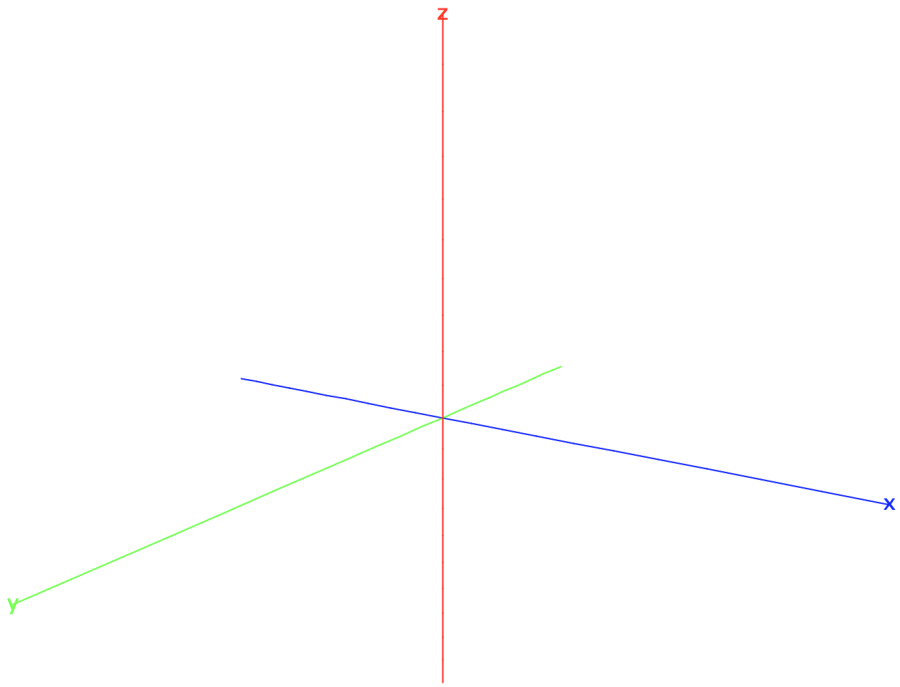
Find T that converts from world coordinates to clipping coodinates.

$$T : WorldSpace \longrightarrow_W CameraSpace \longrightarrow_C ClipSpace$$

$C : \mathbb{R}^3 \to \mathbb{R}^2$ uses the focal length to divide out the z coordinate. So, in CameraSpace the z-axis is perpendicular to the view plane.

$W = [T]_c^w : \mathbb{R}^3 \to \mathbb{R}^3$ transforms a vector written in world coordinates to the same vector in camera coordinates.




z
x
y