CPSC 314
Computer Graphics

Dinesh K. Pai

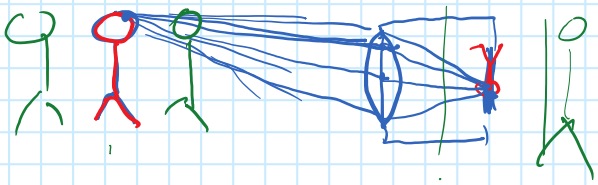
Cameras and Projection (Chapter 10)

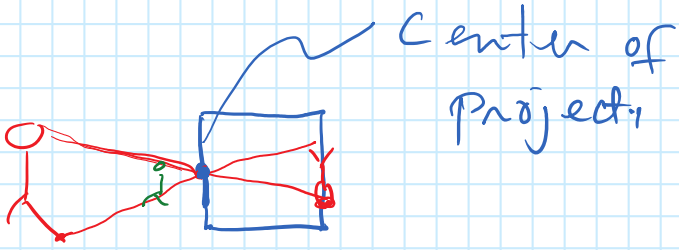
Preliminaries

- Reminders and Announcements
  - Switching to in-person teaching next week!
  - Read Faculty of Science blog post for students about return-to-classes https://science.ubc.ca/students/blog/update-2021w-term-two.
  - Note: this will NOT be a hybrid course. We are not required to stream the lecture or provide recordings.
  - However, to help students learn from home I will try to provide recordings of the lecture, for self study. Evaluating a couple of different ways of doing that now, but the first week may see some glitches.
- Today
  - Projection and perspective

February 4, 2022 9:52 AM

§ Camera





Real Camera

We will ignore lens effects, eg. Depth of field

Pin hole Camera

Everything is in focus

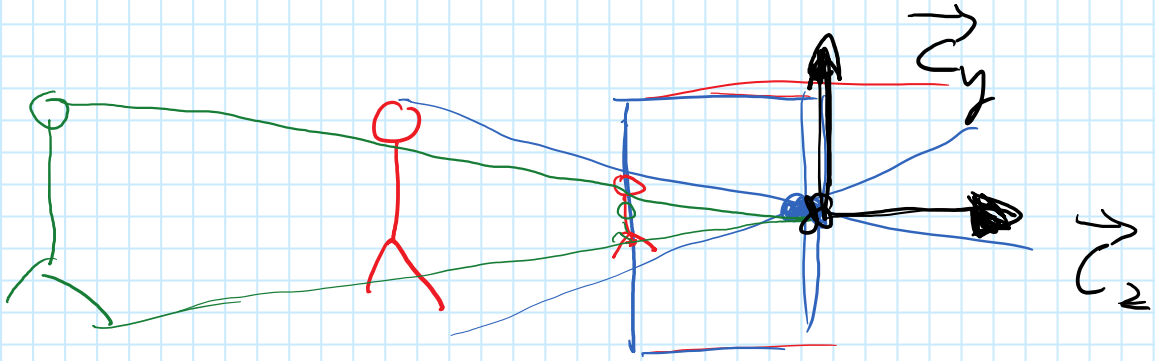
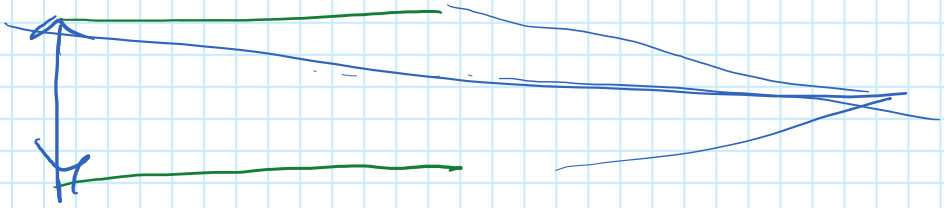


Image Plane

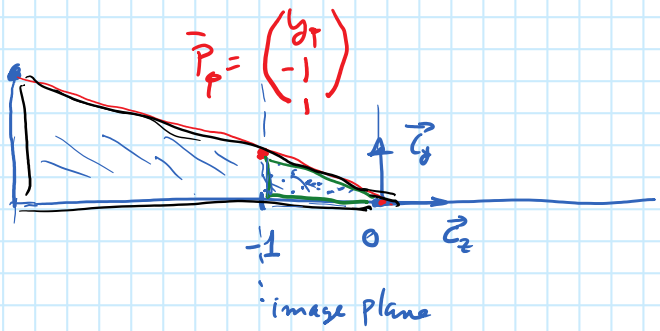
"graphics camera"



§ A mathematical model (in 2D, 3D is simple extension)

"similar triangles"

$\begin{pmatrix} y \\ z \\ 1 \end{pmatrix} - \bar{P}_e$



Find y_p

$$\frac{y_p}{y} = \frac{-1}{z} \Rightarrow \boxed{y_p = \frac{y}{-z}}$$

In homogeneous coordinates

$$\begin{pmatrix} y \\ z \\ 1 \end{pmatrix} \longrightarrow \begin{pmatrix} y/-z \\ -1 \\ 1 \end{pmatrix}$$

Not a linear transform

★ Important generalization of homogeneous.

$$\begin{pmatrix} 3.1\,y \\ 3.1\,z \\ 3.1 \end{pmatrix} = \begin{pmatrix} 2y \\ 2z \\ 2 \end{pmatrix} = \begin{pmatrix} y \\ z \\ 1 \end{pmatrix} \equiv \begin{pmatrix} wy \\ wz \\ w \end{pmatrix}$$

← any non-zero number ⇒ point

$$\begin{pmatrix} y \\ z \\ 1 \end{pmatrix} \longrightarrow \begin{pmatrix} y/-z \\ -1 \\ 1 \end{pmatrix} \equiv \begin{pmatrix} y \\ z \\ -z \end{pmatrix}$$

$$\begin{pmatrix} y \\ z \\ -z \end{pmatrix} = \left[\begin{array}{cc|c} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \hline 0 & -1 & 0 \end{array}\right] \begin{pmatrix} y \\ z \\ 1 \end{pmatrix}$$

gl_position

almost what the Projection matrix in your vertex shader looks like

Still has the flaw that we have lost all depth information

need "Projective Transformation"