

Announcements

- Project team and abstract due Oct 8, IN CLASS!
- MP2 is out, due Sep 29, 11:59pm.
- Reading: Chapter 6 and 7 of Shirley.
- Additional resource for geometric transformations background.
Free online book: S. M. LaValle, "Planning Algorithms"

Announcements

Project team and abstract due Oct 8, IN CLASS! See piazza for announcement later today.

Two types of projects (Piazza post @87) <https://piazza.com/class/id6an59nkxp3hb?cid=87>

- supervised
- unsupervised

Do not wait until the last minute (day, week) - professors are busy!
Start contacting professors today.



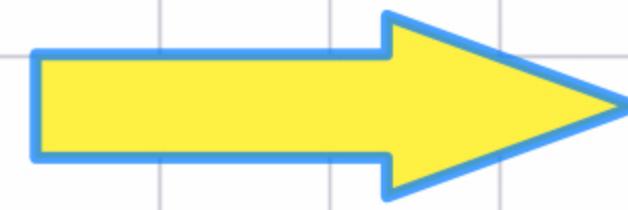
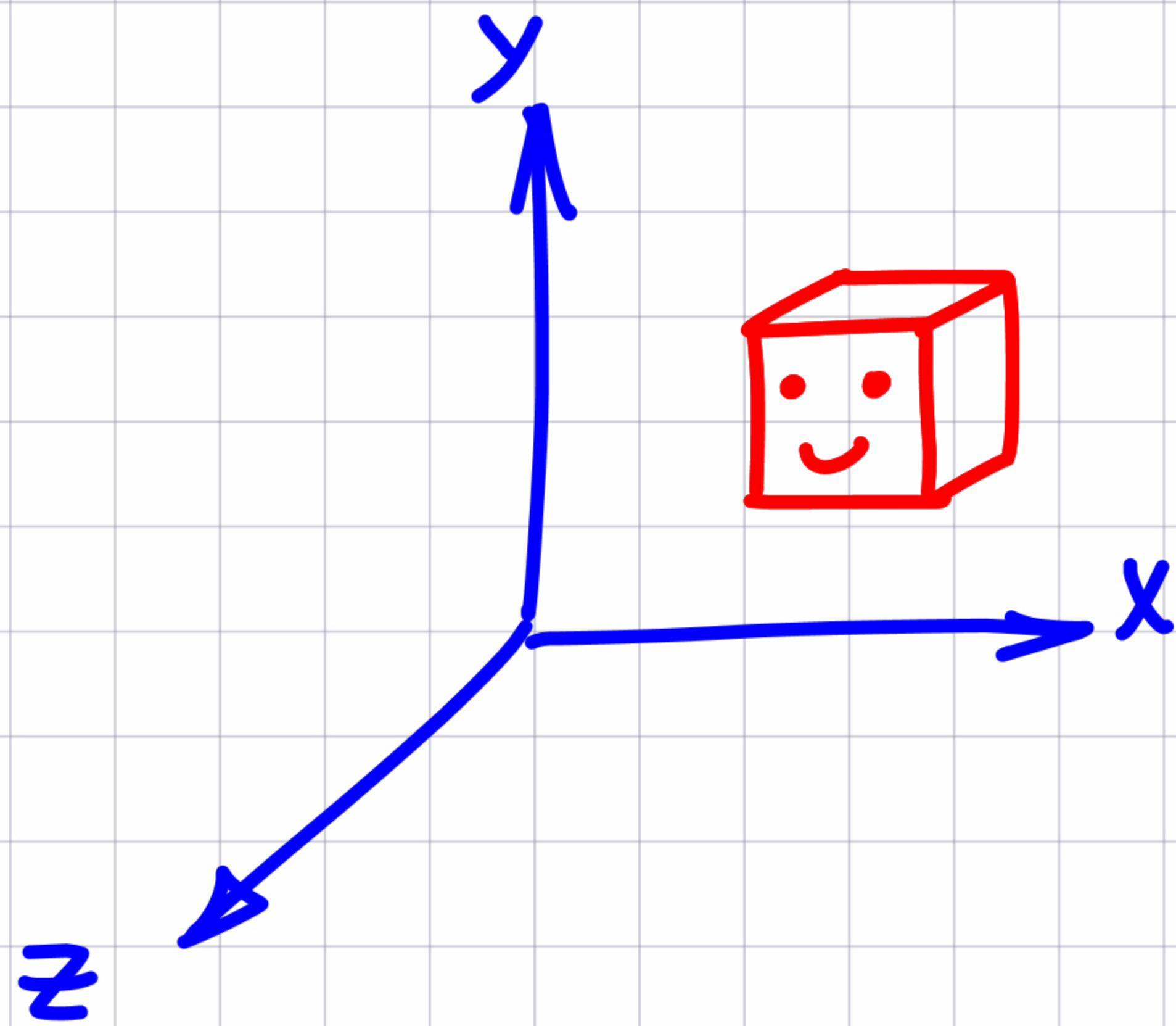
Viewing Transformations



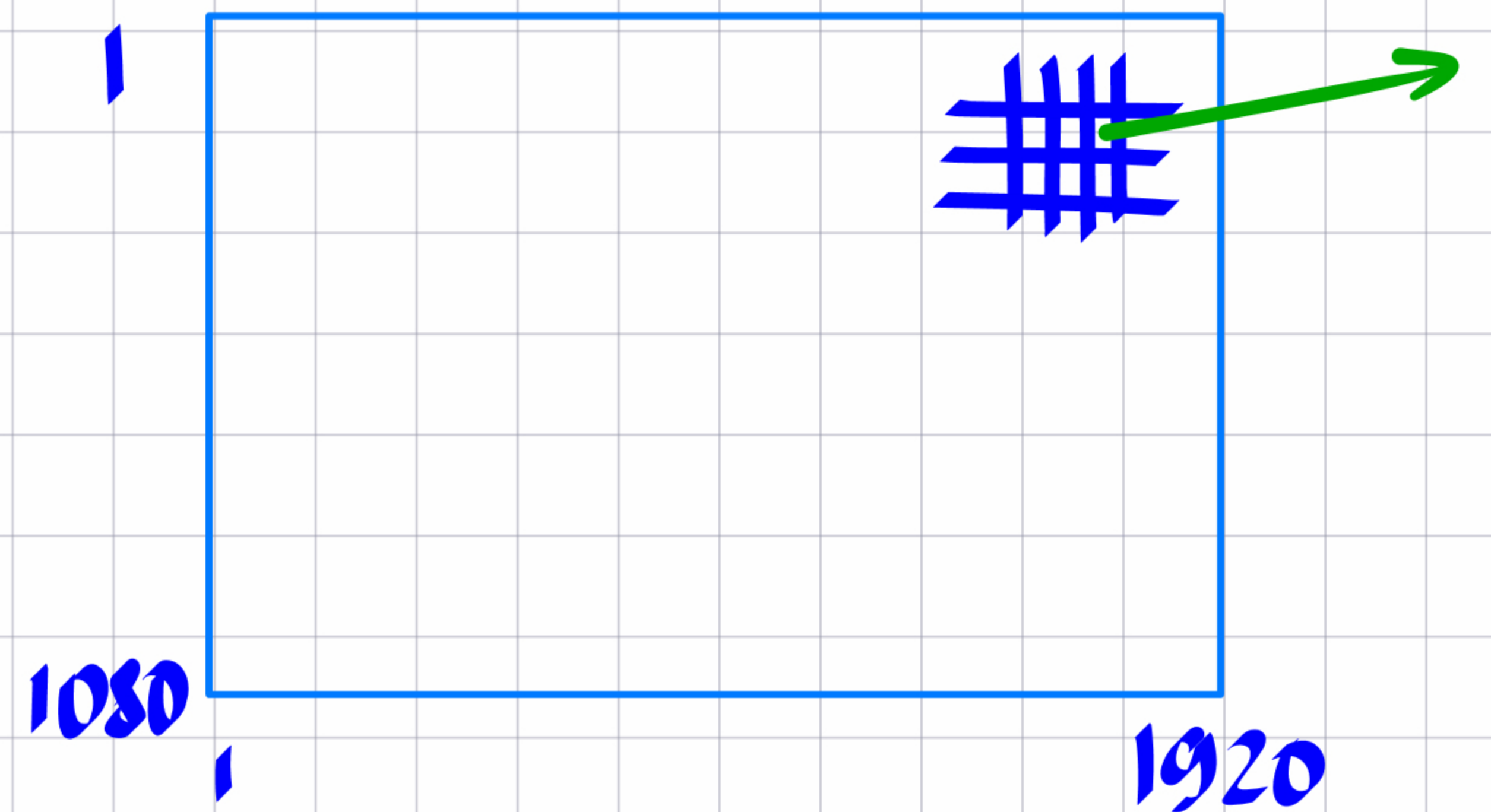
Use of computer graphics
in the Oculus Rift.

From World Coordinate Frame to Pixels on Screen

Alternate World @



Display / Screen
frame @



Goal:

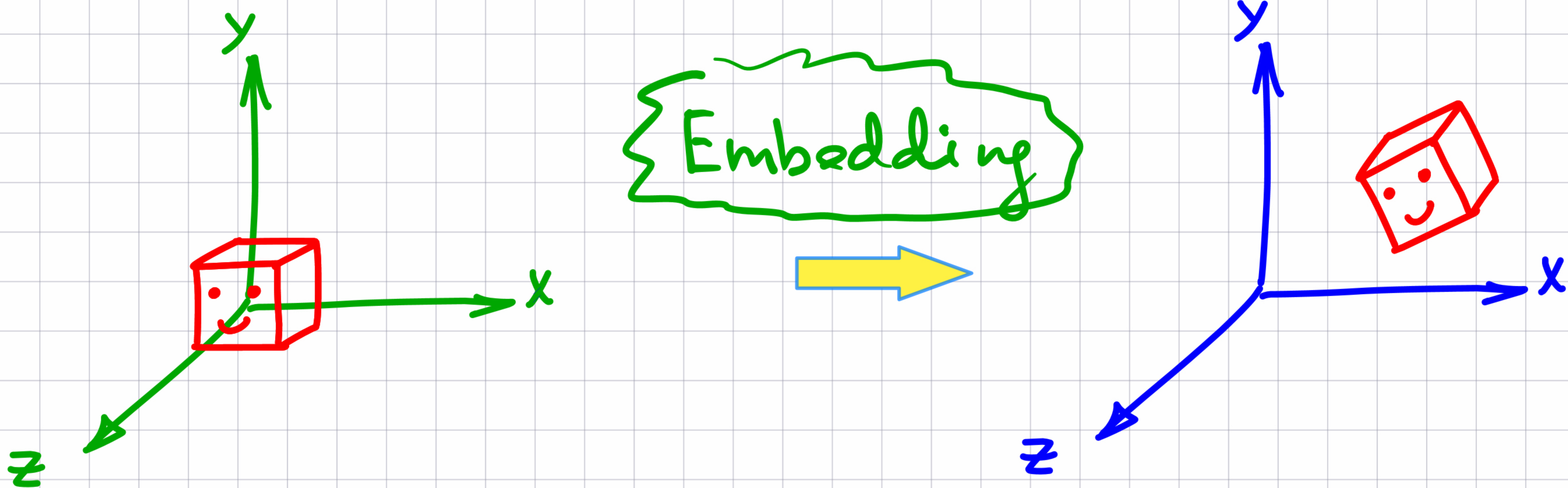
Ignore for now:

What is different from previous geometric transformations?

Object Frame to World Frame

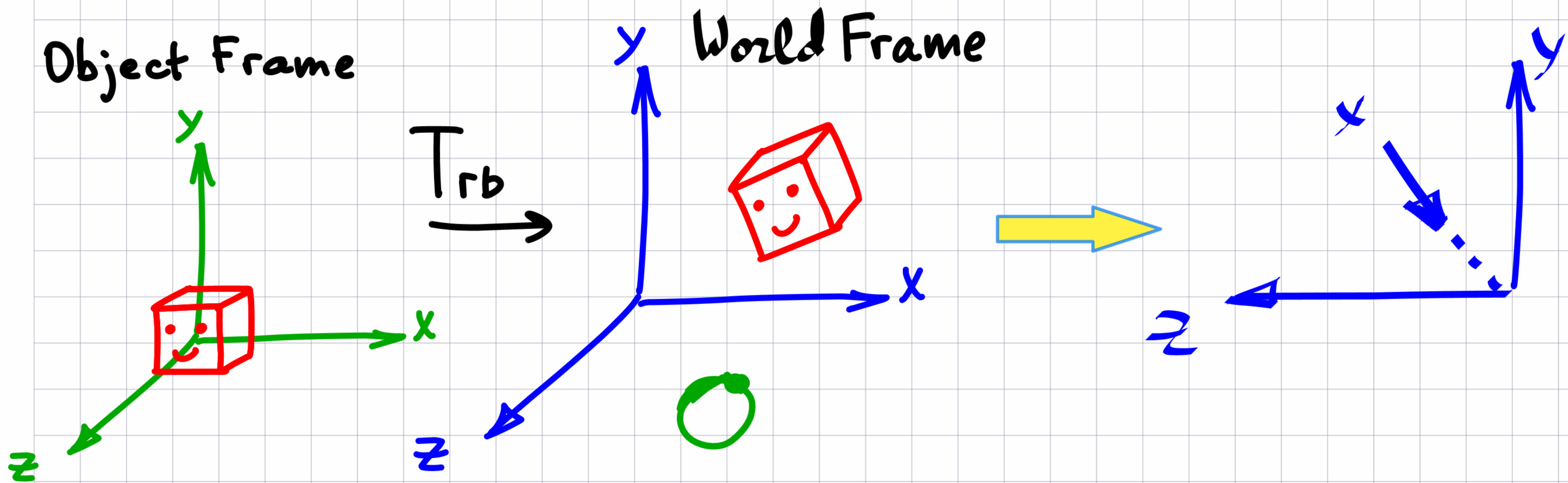
Object Frame (local)

World Frame (global)



The chain of transformations starts with
for moving objects,
for stationary objects.

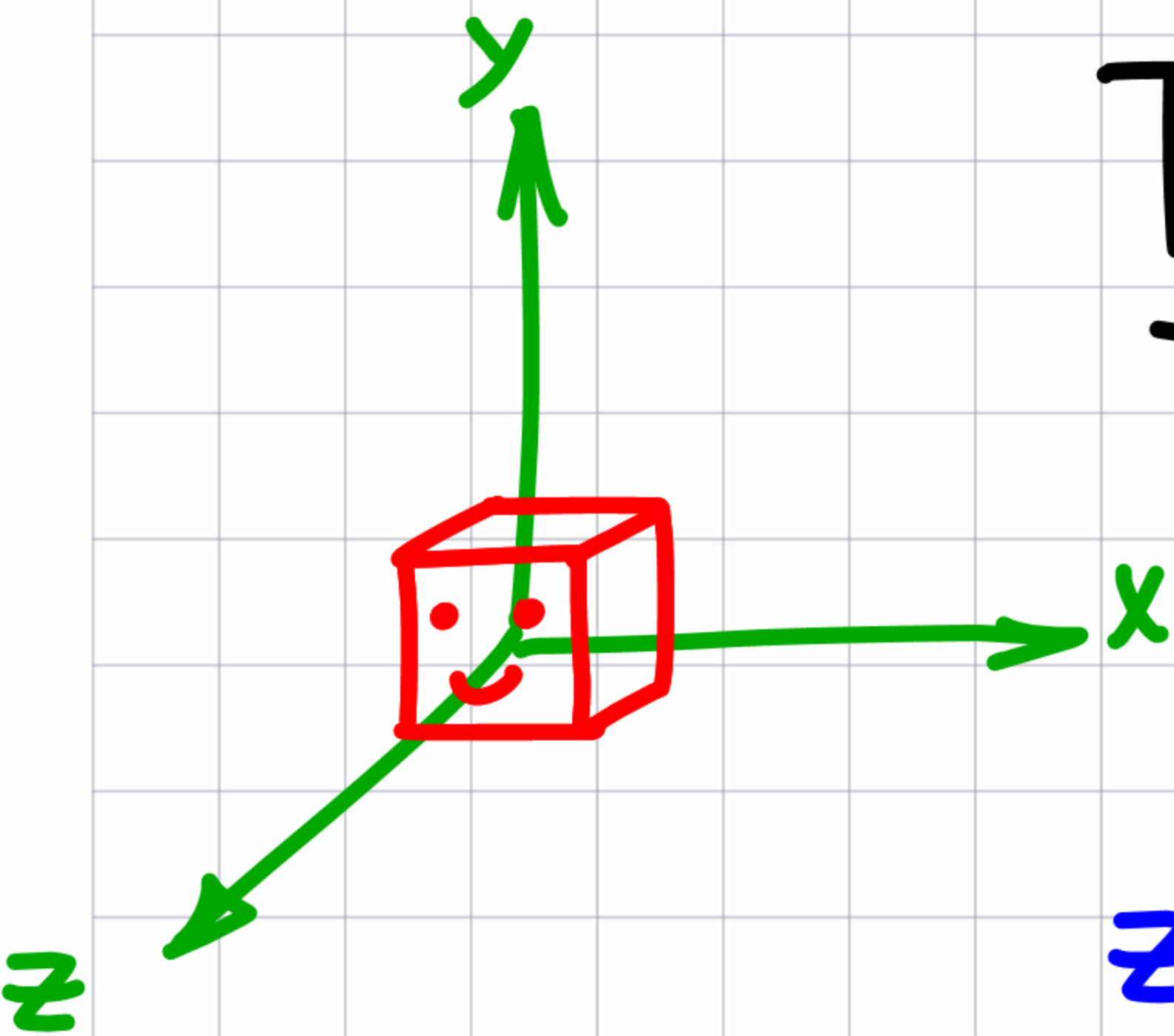
World Frame to Eye Frame



Eye is a rigid body, too.

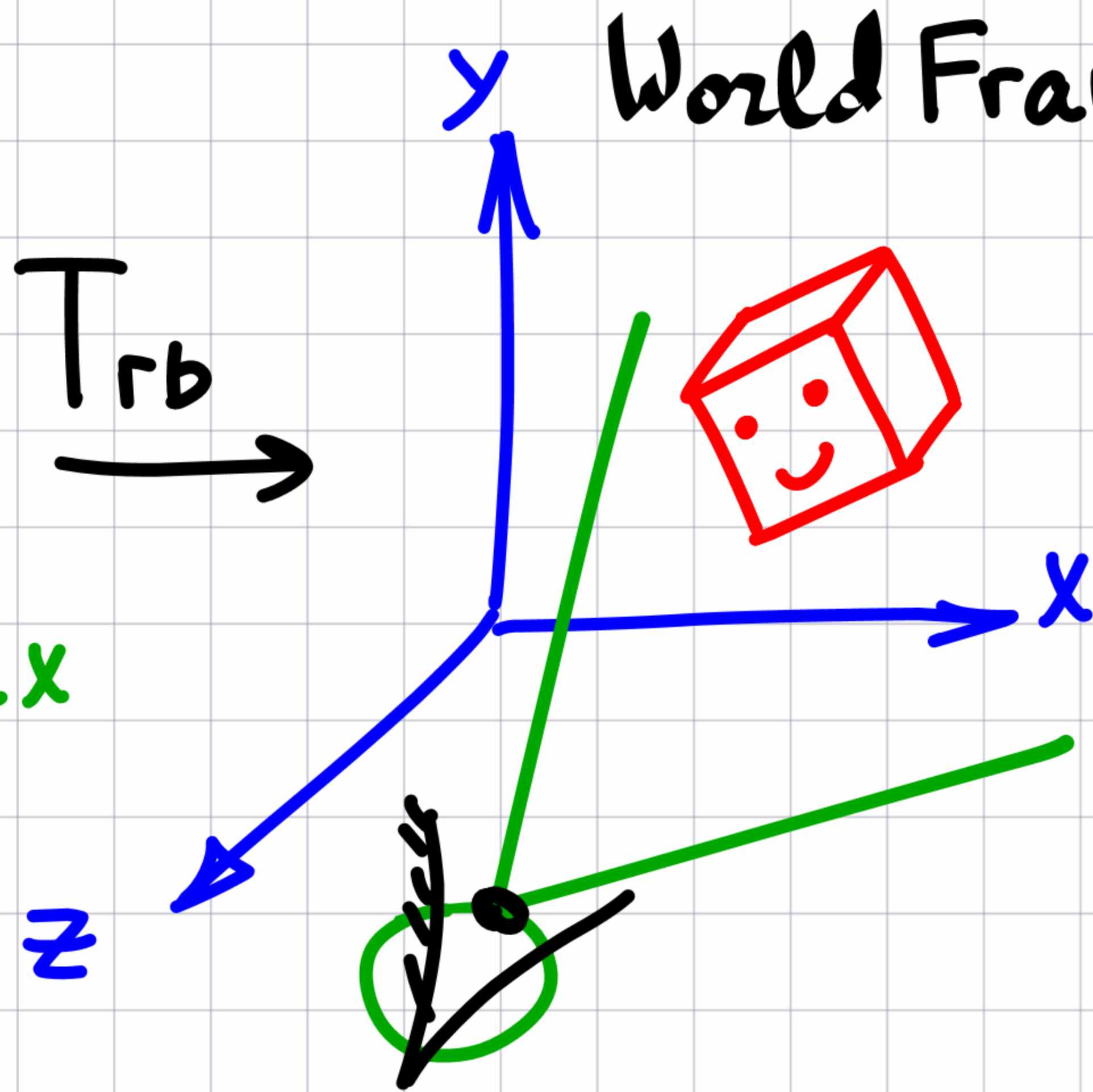
Eye Frame to Canonical Frame

Object Frame



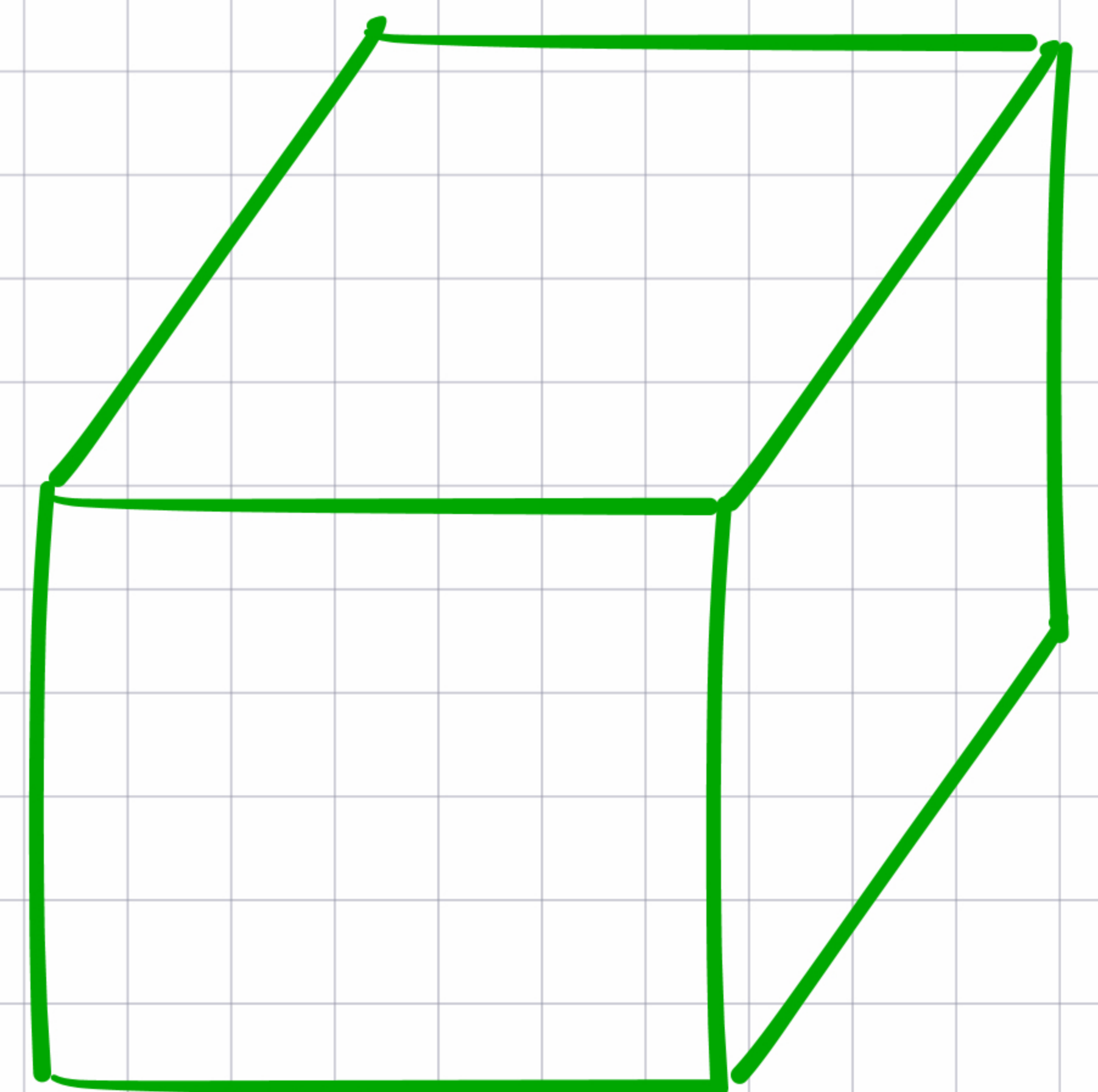
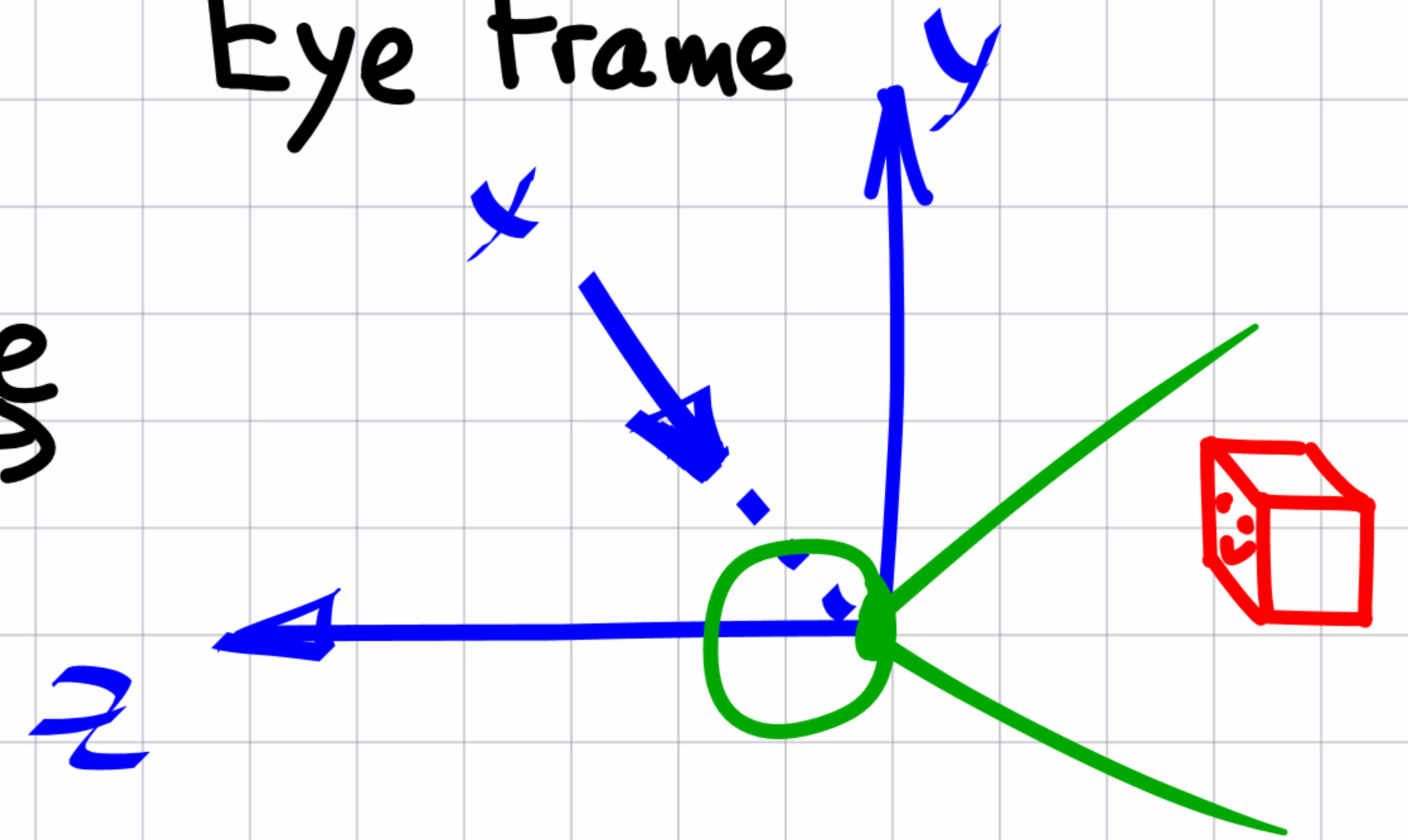
T_{rb}

World Frame



T_{eye}

Eye Frame

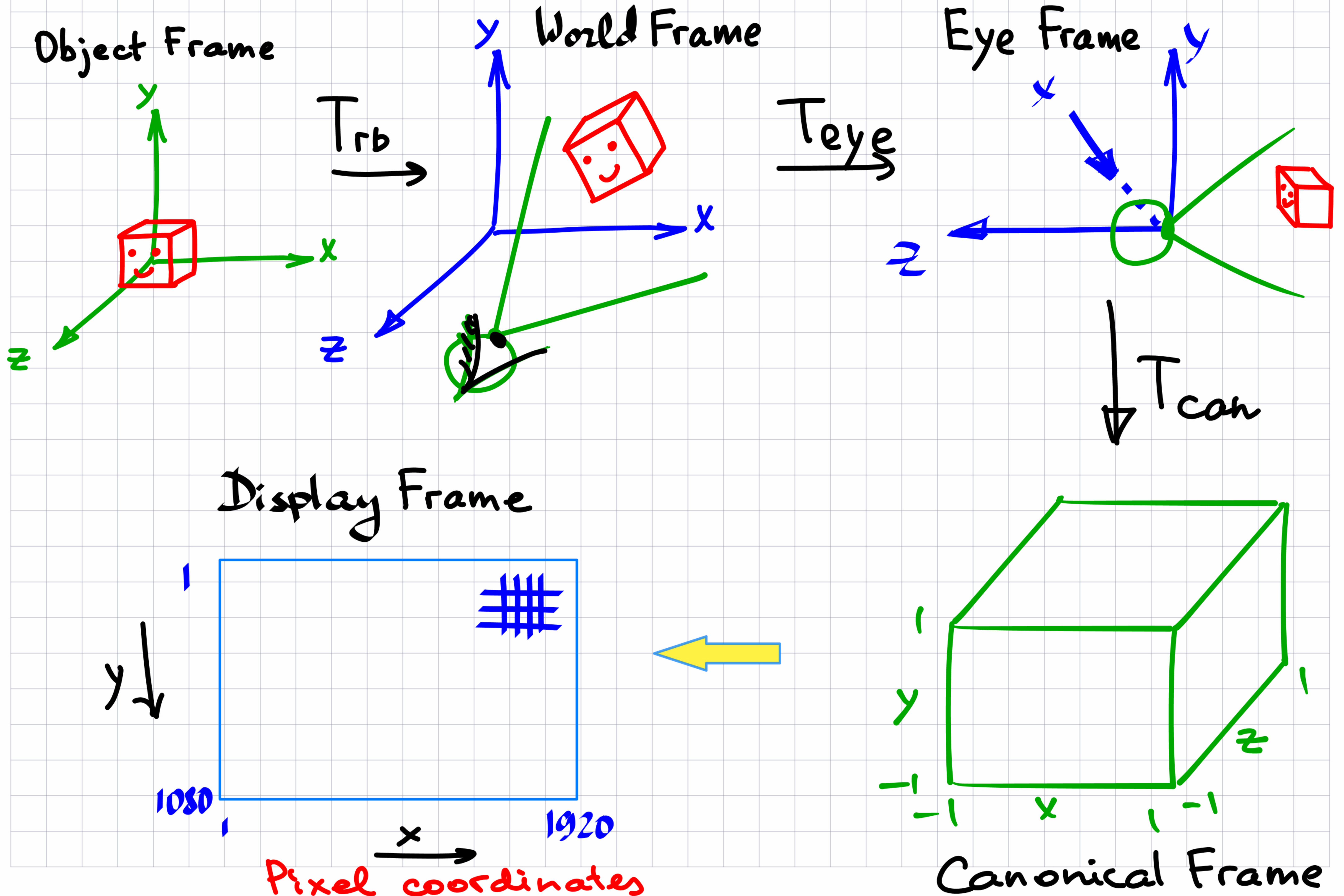


In canonical frame

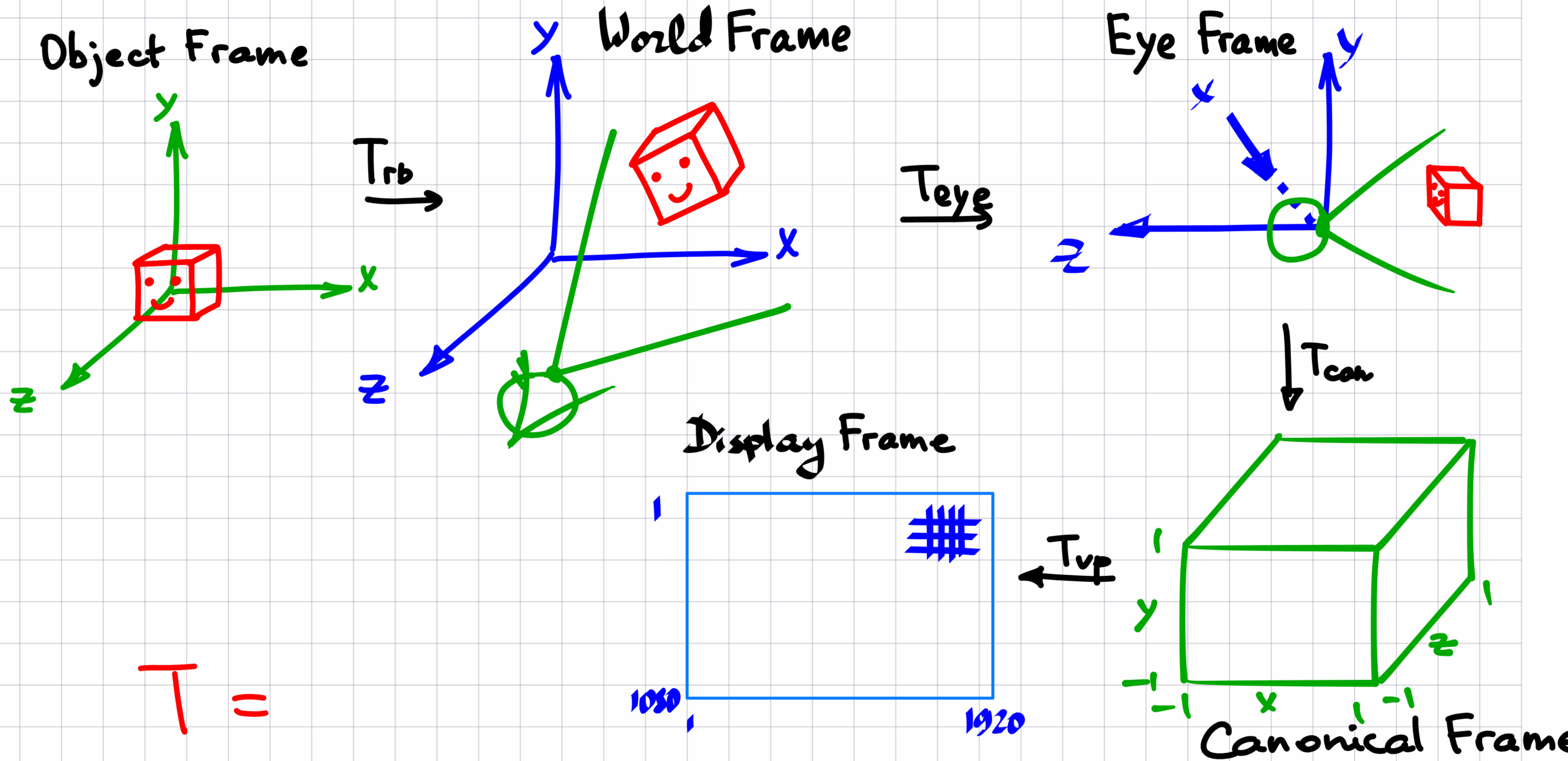
x, y coordinates:

z coordinate:

Canonical Frame to Viewport Frame



Algebraic Representation



VR;

Screen Coordinates;

Algebraic Representation: Eye Transformation

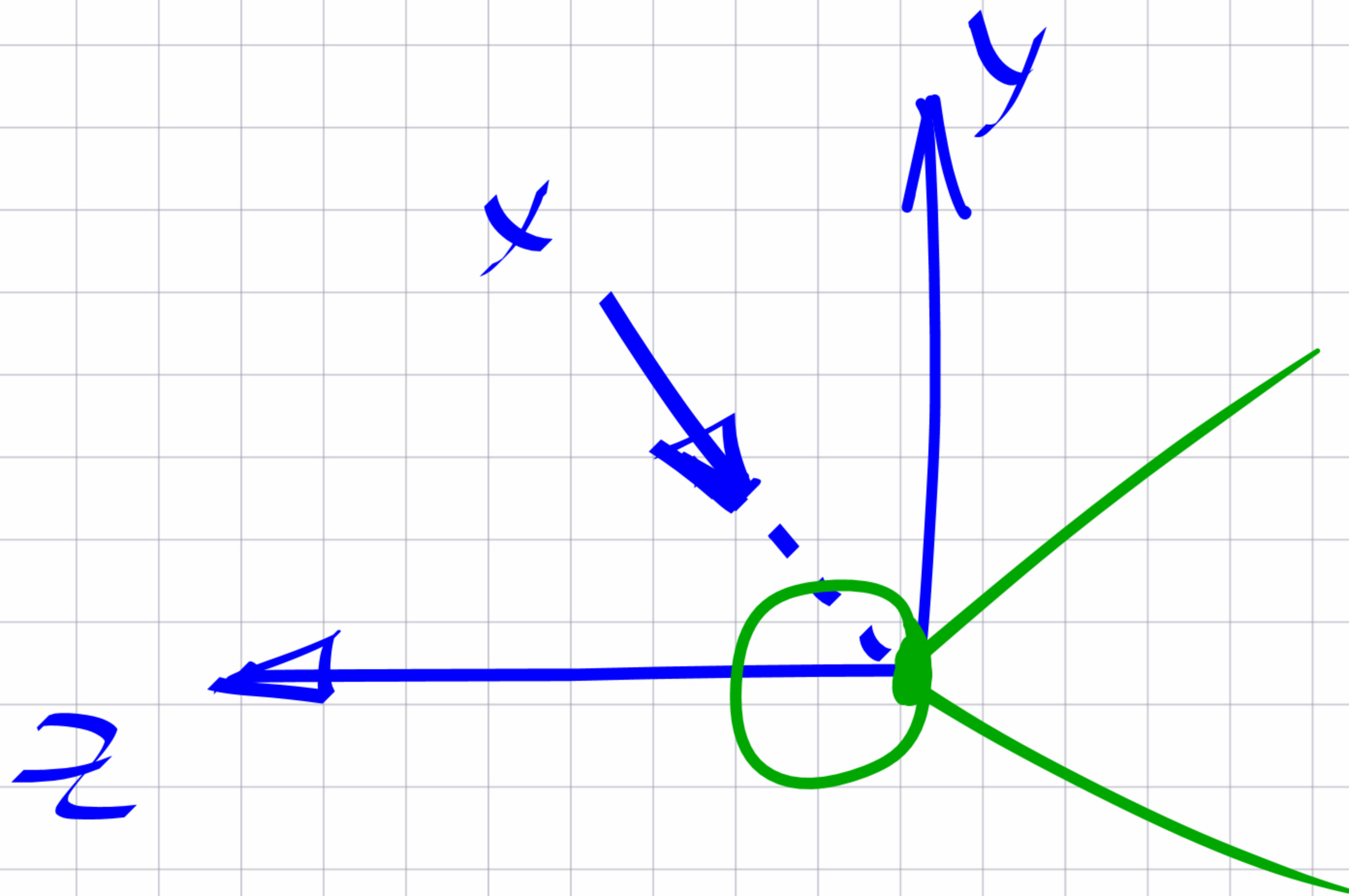
Cyclopean

Consider a "look at":

1.

2.

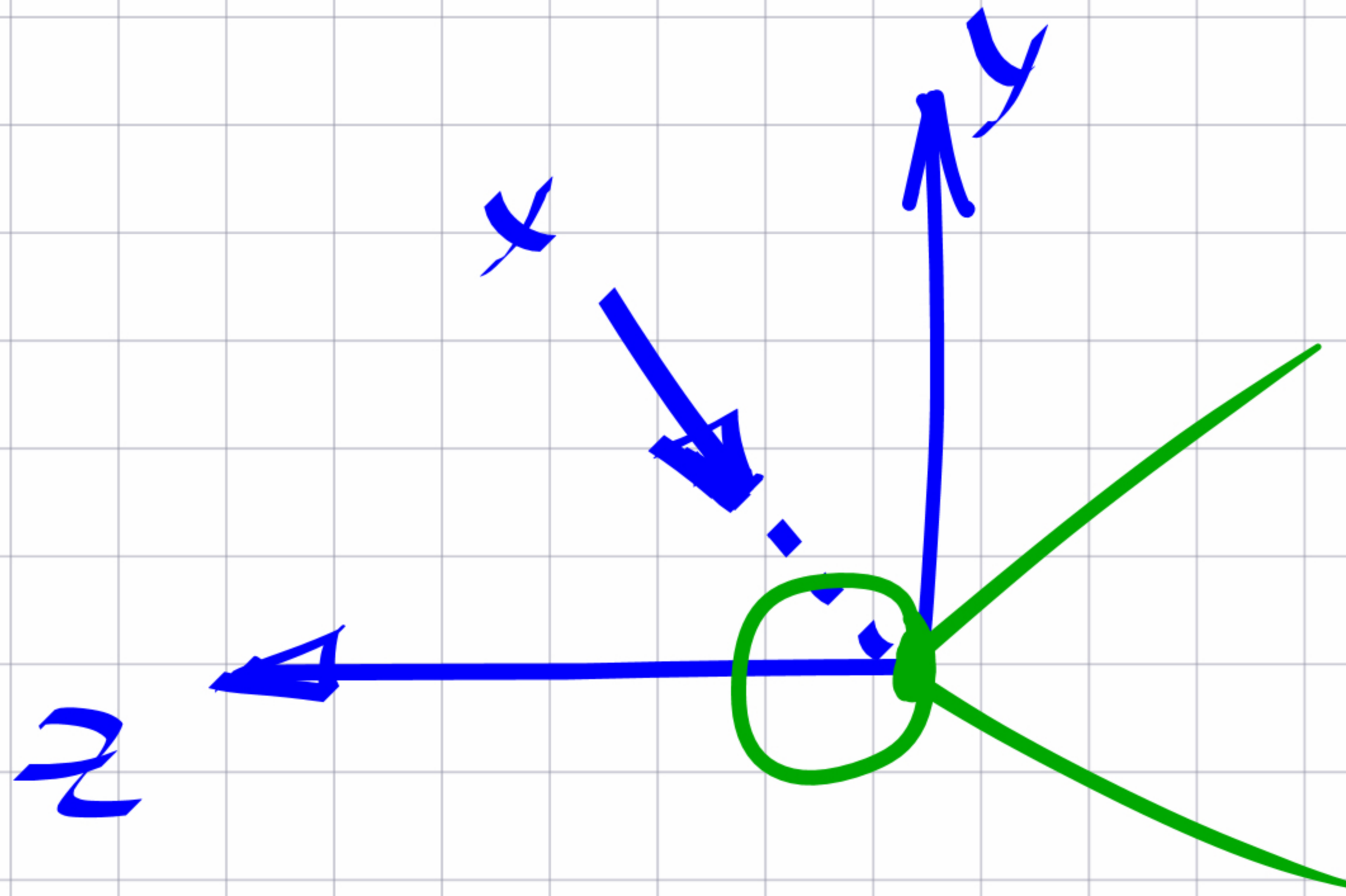
3.



In graphics:

In VR!

Algebraic Representation: Eye Transformation



Consider a "look at":

1. Position of the eye, \vec{e}
2. Looking direction, \hat{c}
3. Up direction, \hat{u}

Coordinate axis for the eye in the world:

$$\hat{x} =$$

$$\hat{y} =$$

$$\hat{z} =$$

Rotation matrix:

$$R = \begin{bmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{bmatrix}$$

Algebraic Representation: Eye Transformation

Cyclopean

To place the eye in the world:

$$T_{e,w} =$$

To convert from world frame to eye frame:

$$T_{eye} =$$

Algebraic Representation: Left Eye Transformation

To place the eye in the world:

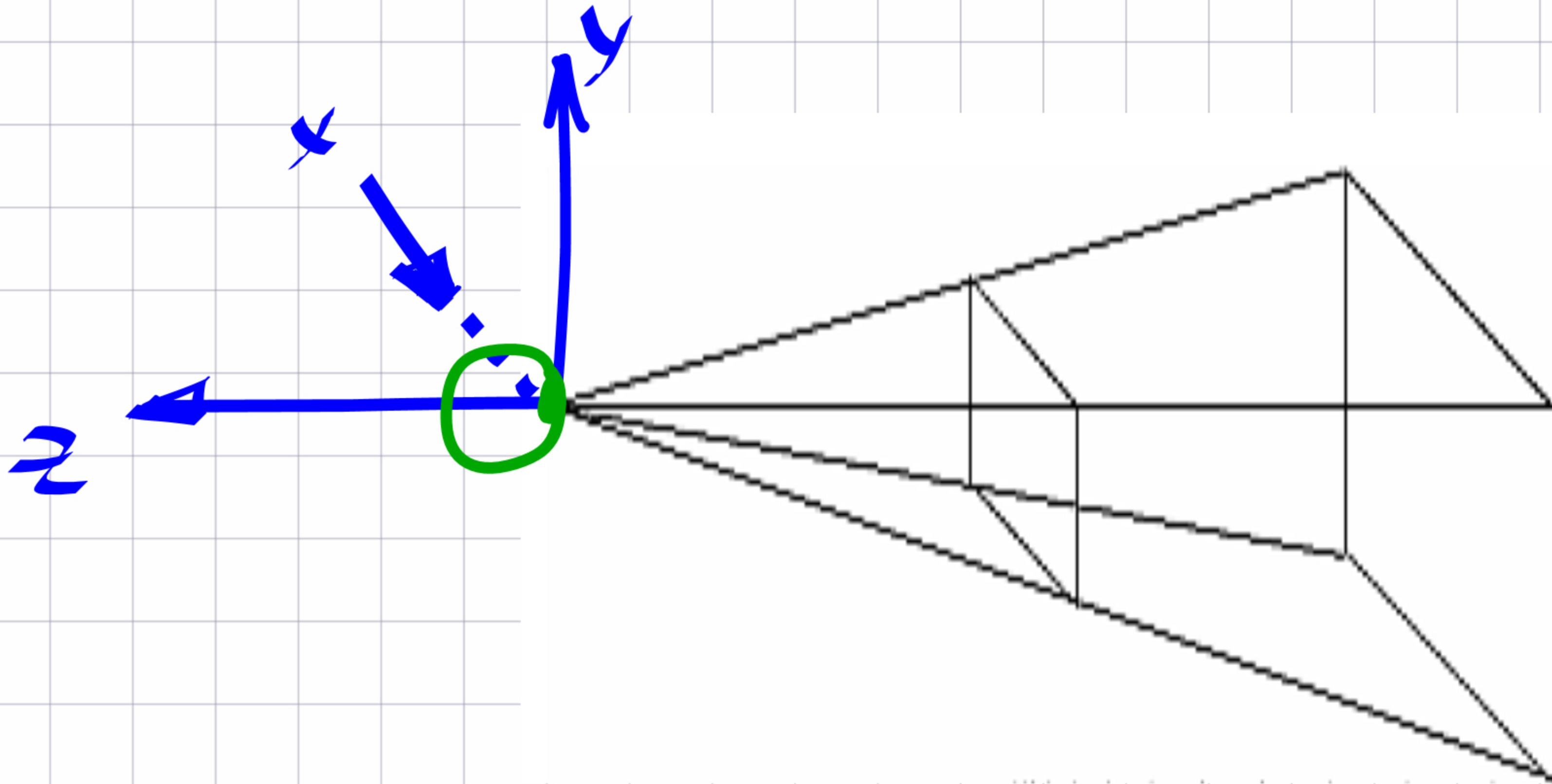
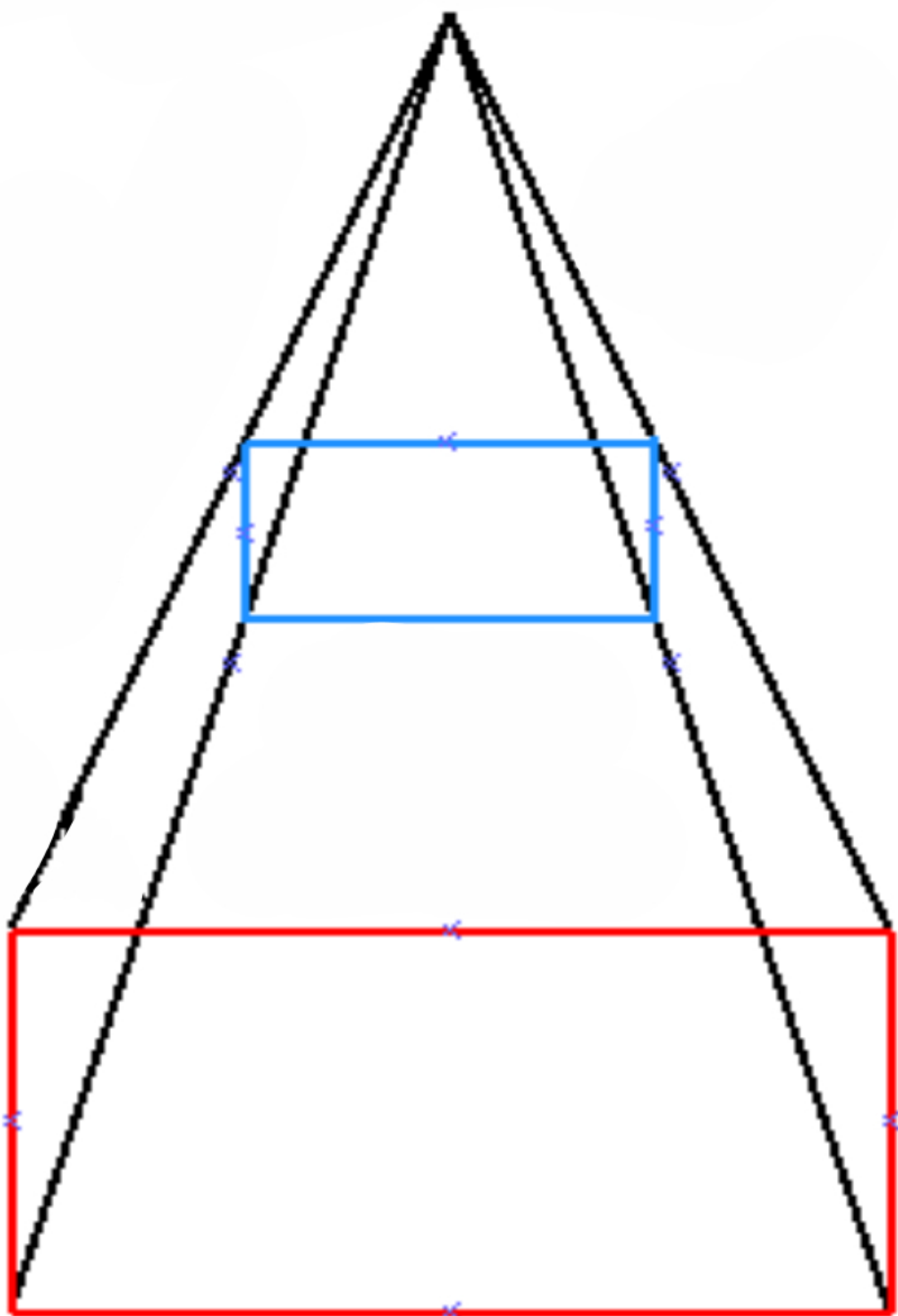
$$T_{e,w} =$$



To convert from world frame to eye frame:

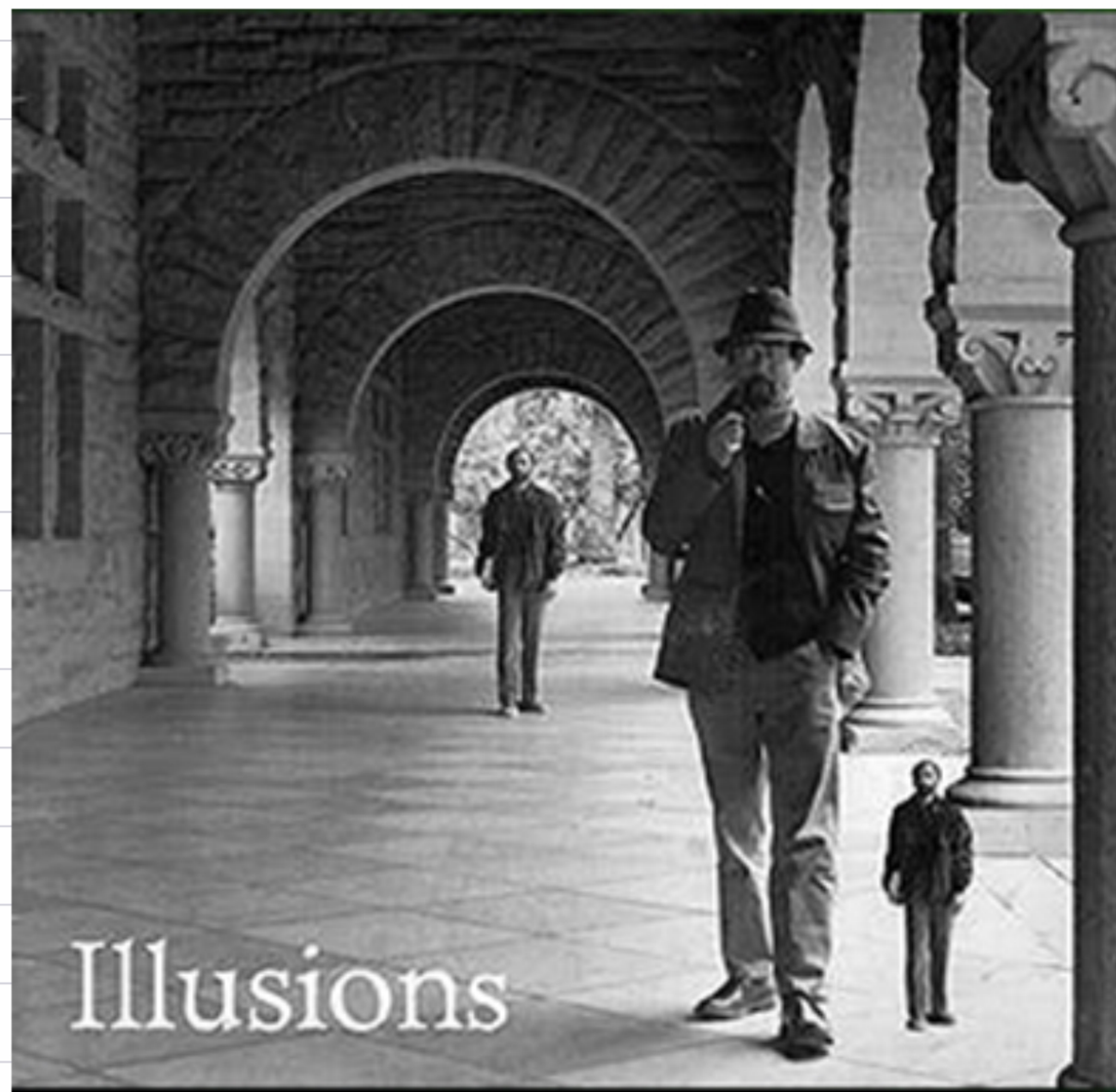
$$T_{eye} =$$

Algebraic Representation: Canonical Transformation

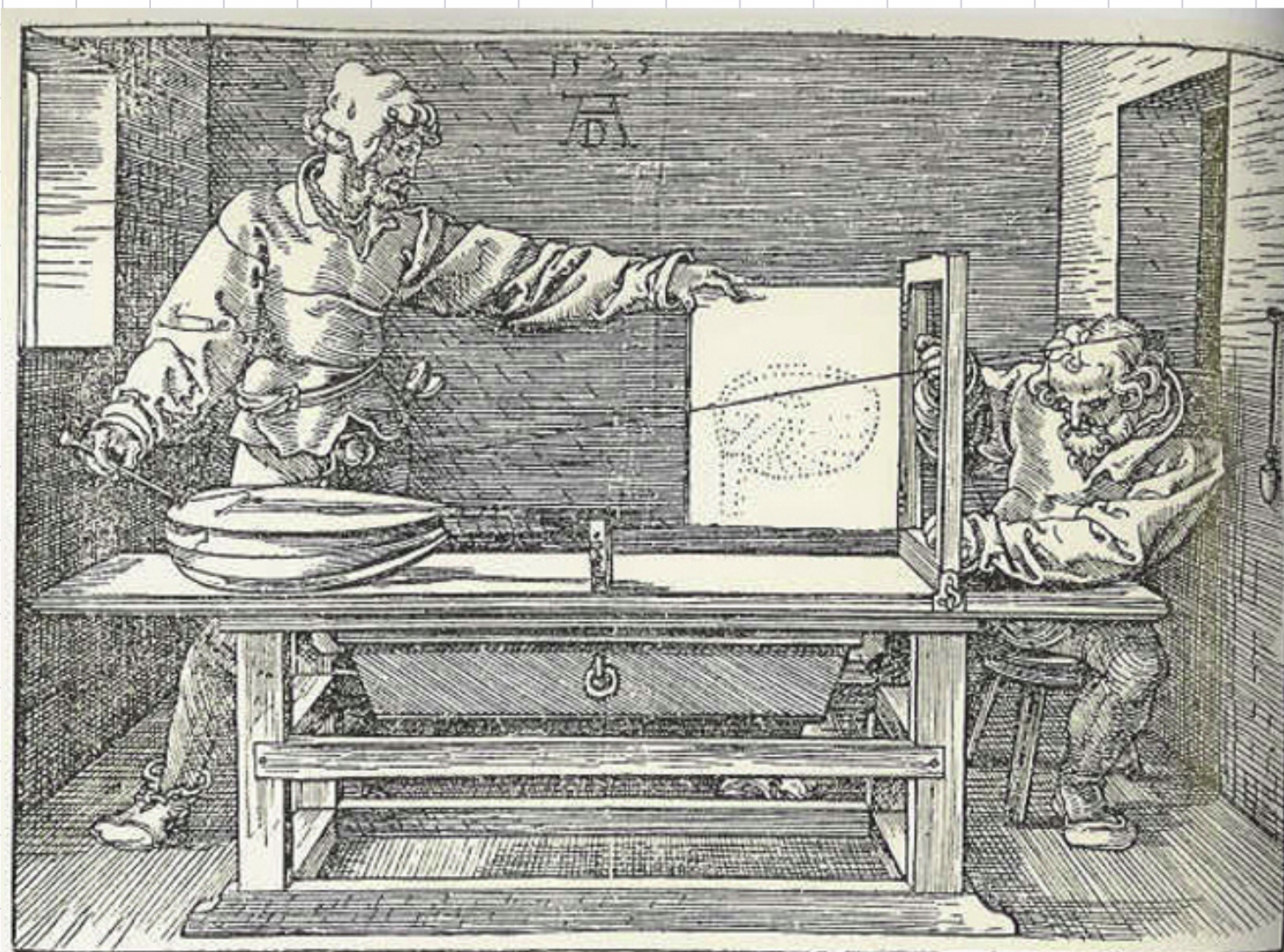




Andrea Mantegna
The Lamentation over
the Dead Christ 1490



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More Durer, swiped from Fredo Durand's Art of Depiction

Canonical Transformation: 2D Analogy

