CS251 HW 3 | Mon Feb 25, 2019 | Week 4

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Question 1

Write the scale matrix that would *in part* transform 3D points in normalized view volume coordinates to screen coordinates (i.e. other matrices not asked about here are required to complete the coordinate transform). Assume the observer and viewer volume coordinate axes are currently aligned and that the target app window is 800 x 600 px (width x height).

Assume the usual initial observer coordinate system vectors $\left(\vec{U} = (-1, 0, 0), V\vec{U}P = (0, 1, 0), V\vec{P}N = (0, 0, -1)\right)$.

Important note: Make sure you understand why all the signs are the way that they are!!

$$\begin{bmatrix} -800 & & & 0 \\ & -600 & & \\ & & 1 & \\ 0 & & & 1 \end{bmatrix}$$

Question 2

Please answer the following questions about interactive panning.

a) On many laptops, scrolling with two fingers on the trackpad moves content in the *opposite* direction of your fingers (e.g. two fingers down moves content up on the screen). However, on the iPad gliding your finger on the screen moves content in the same direction as your finger (e.g. gliding down moves content down on the screen). When viewing scrolling as interactive panning, at what stage of the process could we implement this reversal in the direction of control?

When defining Kp, ~~make the reve~~ negate the reversed component!

b) What changes should we make if horizontal panning results in movement twice as fast as we'd like?

Cut Kpx in half - $\frac{E_x}{S_x}$ becomes $\frac{E_x}{2 S_x}$

c) If the data appear to be moving down and to the right when panning, how is the observer's position (VRP) changing?

UP & left

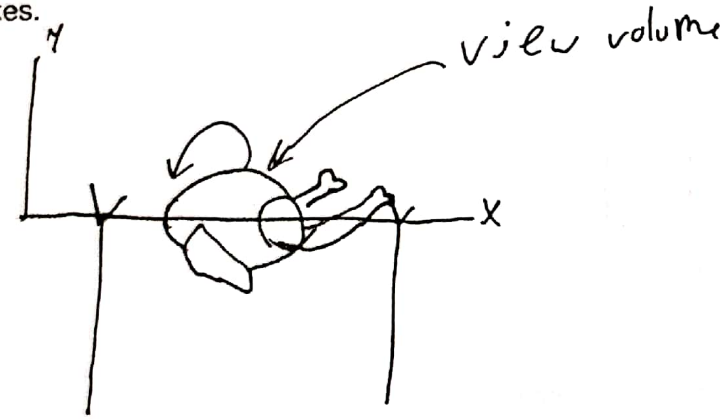
Question 3

a) Suppose that we wanted to rotate the observer's view of the data in a 3D view volume about its X axis. Write the rotation matrix R_x that rotates the view by angle 20°.

Be careful with your signs!

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(20) & -\sin(20) & 0 \\ 0 & \sin(20) & \cos(20) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

b) Draw a simple diagram that *clearly* illustrates the effect of rotation about the view volume X axis. Be sure to label your axes.



c) If the observer is positioned at (10, 20, 25), the view volume is (100, 100, 100), and the observer coordinate system is $\left(\vec{U} = (-1, 0, 0), V\vec{U}P = (0, 1, 0), V\vec{P}N = (0, 0, -1)\right)$, write the matrices that

- bring the center of the view volume to the origin
- align the observer and view volume coordinates

a) $$\begin{bmatrix} 1 & 0 & 0 & -100 \\ & 1 & 0 & -100 \\ 0 & & 1 & -100 \\ & & & 1 \end{bmatrix}$$

b) $$\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

d) Write the matrices that "undo" each of the transformations from c. In what order should we apply these "undoing" matrices?

First, undo alignment:

$$\begin{bmatrix} -1 & & & \\ & 1 & & 0 \\ & & -1 & \\ 0 & & & 1 \end{bmatrix}$$

Then, Translate

$$\begin{bmatrix} 1 & 0 & 0 & 100 \\ & 1 & 0 & 100 \\ & & 1 & 100 \\ 0 & & & 1 \end{bmatrix}$$

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