

## Checkpoints 1 and 2: Order of Rotations

### CSC 322 Blender Activity 2

#### Checkpoint 1

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \pi/4 & -\sin \pi/4 \\ 0 & \sin \pi/4 & \cos \pi/4 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\begin{aligned} (1 \cdot 1) + (0 \cdot 1) + (0 \cdot 1) &= 1 + 0 + 0 = 1 \\ (0 \cdot 1) + (\cos \pi/4 \cdot 1) + (-\sin \pi/4 \cdot 1) &= 0 + \sqrt{2}/2 - \sqrt{2}/2 = 0 \\ (0 \cdot 1) + (\sin \pi/4 \cdot 1) + (\cos \pi/4 \cdot 1) &= 0 + \sqrt{2}/2 + \sqrt{2}/2 = \sqrt{2} \end{aligned}$$

$$\begin{bmatrix} \cos \pi/4 & 0 & \sin \pi/4 \\ 0 & 1 & 0 \\ -\sin \pi/4 & 0 & \cos \pi/4 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ \sqrt{2} \end{bmatrix}$$

$$\begin{aligned} (\cos \pi/4 \cdot 1) + (0 \cdot 0) + (\sin \pi/4 \cdot \sqrt{2}) &= \sqrt{2}/2 + 0 + 1 = 1.707 \\ (0 \cdot 1) + (1 \cdot 0) + (0 \cdot \sqrt{2}) &= 0 + 0 + 0 = 0 \\ (-\sin \pi/4 \cdot 1) + (0 \cdot 0) + (\cos \pi/4 \cdot \sqrt{2}) &= -\sqrt{2}/2 + 0 + 1 = 0.293 \end{aligned}$$

$$p_{xy} = (1.707, 0, 0.293)$$

$$\begin{bmatrix} \cos \pi/4 & 0 & \sin \pi/4 \\ 0 & 1 & 0 \\ -\sin \pi/4 & 0 & \cos \pi/4 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\begin{aligned} (\cos \pi/4 \cdot 1) + (0 \cdot 1) + (\sin \pi/4 \cdot 1) &= \sqrt{2}/2 + 0 + \sqrt{2}/2 = \sqrt{2} \\ (0 \cdot 1) + (1 \cdot 1) + (0 \cdot 1) &= 0 + 1 + 0 = 1 \\ (-\sin \pi/4 \cdot 1) + (0 \cdot 1) + (\cos \pi/4 \cdot 1) &= -\sqrt{2}/2 + 0 + \sqrt{2}/2 = 0 \end{aligned}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \pi/4 & -\sin \pi/4 \\ 0 & \sin \pi/4 & \cos \pi/4 \end{bmatrix} \begin{bmatrix} \sqrt{2} \\ 1 \\ 0 \end{bmatrix}$$

$$(1 \cdot \sqrt{2}) + (0 \cdot 1) + (0 \cdot 0) = \sqrt{2} + 0 + 0 = \sqrt{2}$$

$$(0 \cdot \sqrt{2}) + (\cos \pi/4 \cdot 1) + (-\sin \pi/4 \cdot 0) = 0 + \sqrt{2}/2 + 0 = \sqrt{2}/2$$

$$(0 \cdot \sqrt{2}) + (\sin \pi/4 \cdot 1) + (\cos \pi/4 \cdot 0) = 0 + \sqrt{2}/2 + 0 = \sqrt{2}/2$$

$$p_{yx} = (1.414, 0.707, 0.707)$$

### Checkpoints 3 and 4: Parenting Objects

~~$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & \sqrt{2}/2 & -\sqrt{2}/2 \\ 0 & \sqrt{2}/2 & \sqrt{2}/2 \end{bmatrix} \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$$~~

$$t_{\text{cube}}^{\text{world}} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 0 \\ 3 \end{pmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & \sqrt{2}/2 & -\sqrt{2}/2 & 1 \\ 0 & \sqrt{2}/2 & \sqrt{2}/2 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ -1 \\ 1 \\ 1 \end{bmatrix}$$

$$(1 \cdot 2) + (0 \cdot -1) + (0 \cdot 1) + (1 \cdot 1) = 2 + 0 + 0 + 1 = 3$$

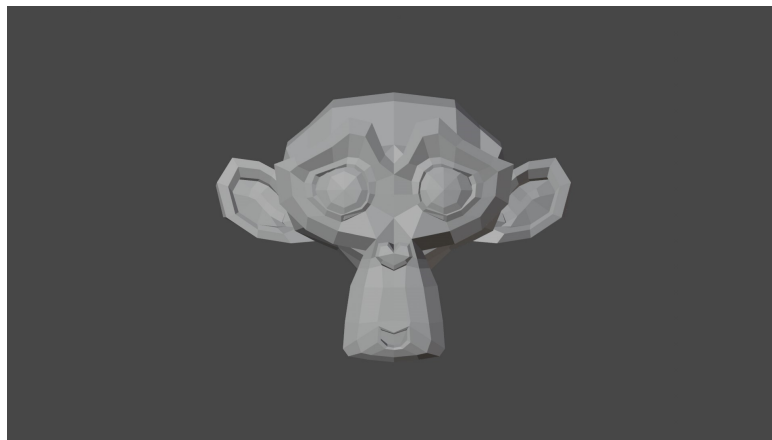
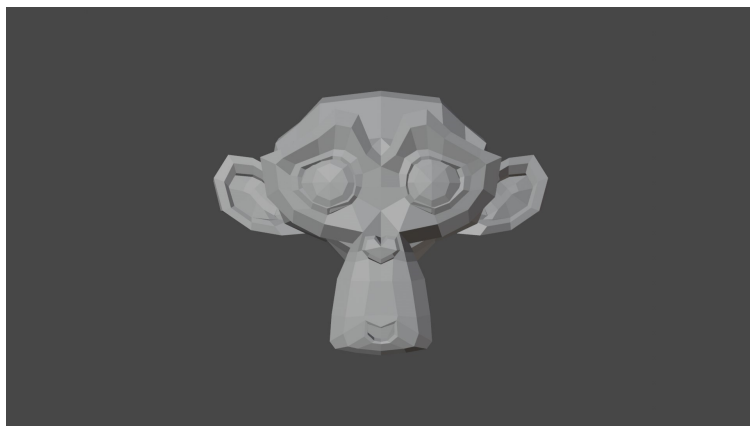
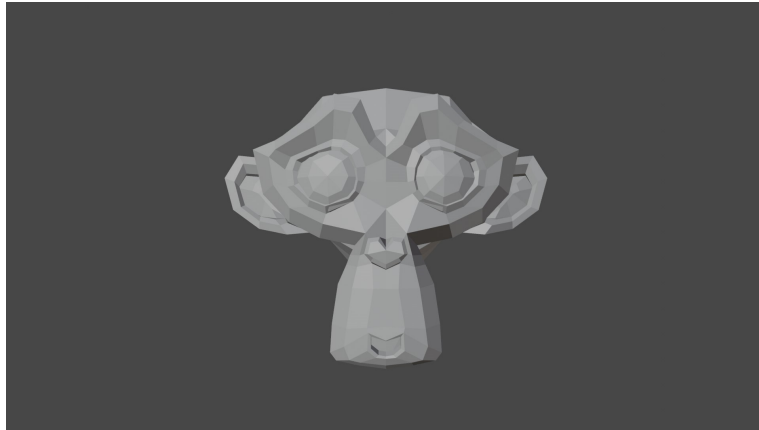
$$(0 \cdot 2) + (\sqrt{2}/2 \cdot -1) + (-\sqrt{2}/2 \cdot 1) + (1 \cdot 1) = 0 - \sqrt{2}/2 - \sqrt{2}/2 + 1 = 1 - \sqrt{2}$$

$$(0 \cdot 2) + (\sqrt{2}/2 \cdot -1) + (\sqrt{2}/2 \cdot 1) + (2 \cdot 1) = 0 - \sqrt{2}/2 + \sqrt{2}/2 + 2 = 2$$

$$(0 \cdot 2) + (0 \cdot -1) + (0 \cdot 1) + (1 \cdot 1) = 0 + 0 + 0 + 1 = 1$$

$$t_{\text{cube}}^{\text{world}} = \begin{pmatrix} 3 \\ -0.4142 \\ 2 \\ 1 \end{pmatrix}$$

## Checkpoints 5 and 6: Camera



Increasing the focal length made the face of the monkey appear farther away, so that you are able to see more of the ears. The monkey's face even seemed to shrink a little bit. This is because there is a narrower angle of view and higher magnification.

## Checkpoint 7: Flat Shading

