

# Vertex Pipeline

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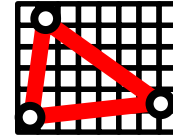
CS418 Computer Graphics

John C. Hart

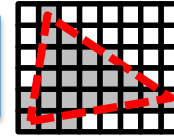
# Vertex Pipeline



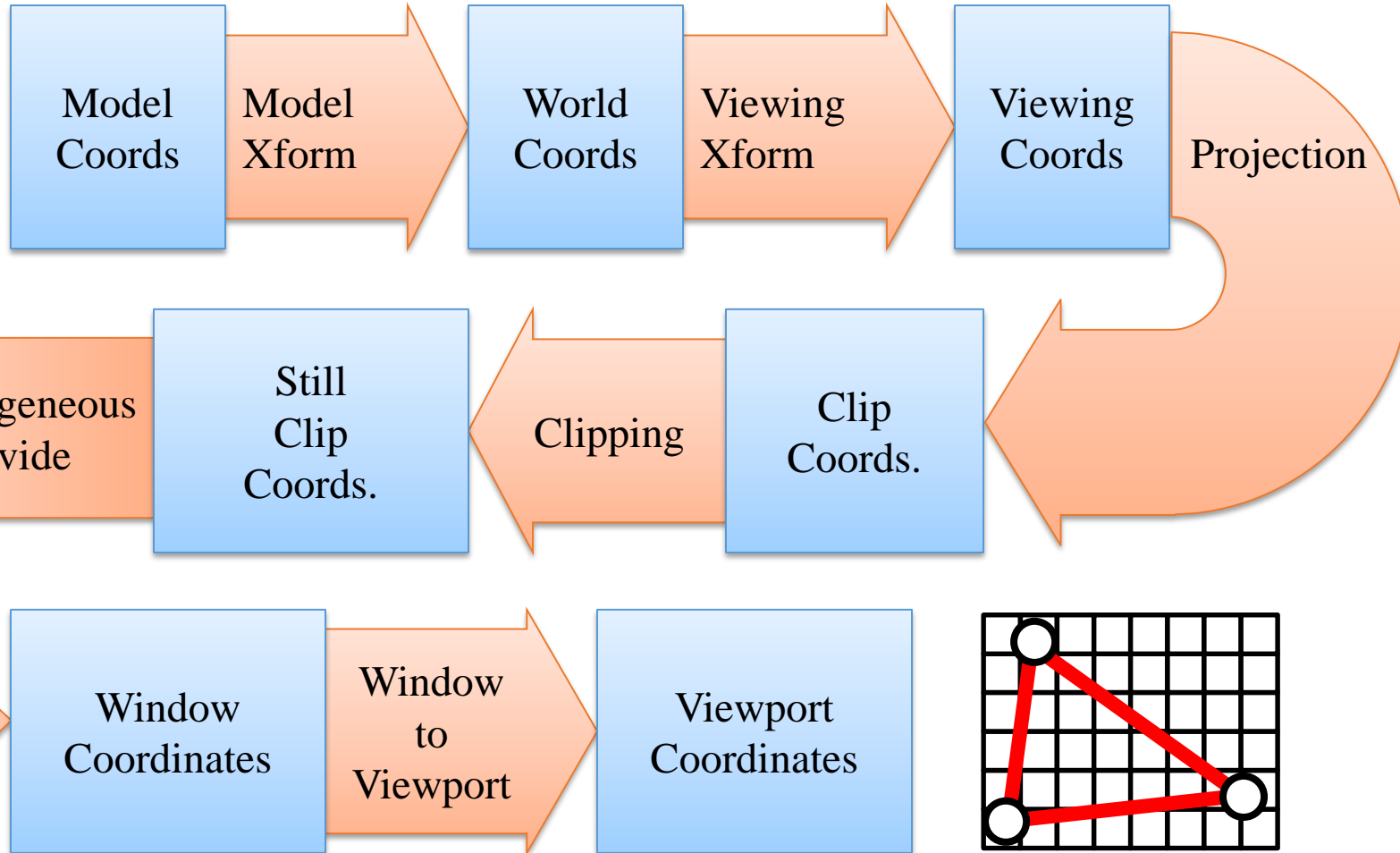
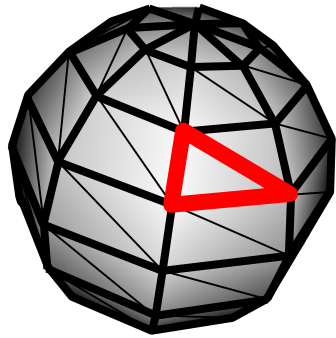
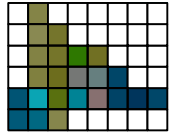
Vertex  
Shader



Scan  
Converter

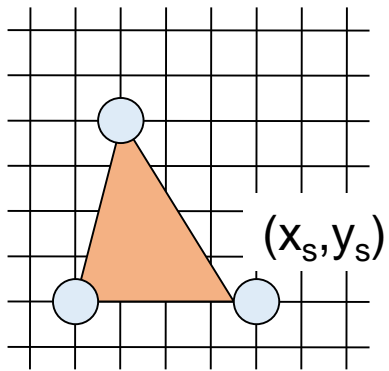


Fragment  
Shader

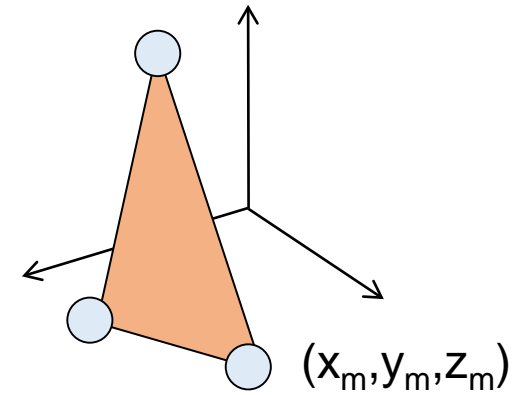


# Vertex Pipeline

viewport (display)  
coordinates



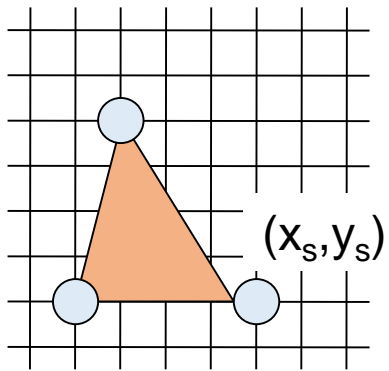
model  
coordinates



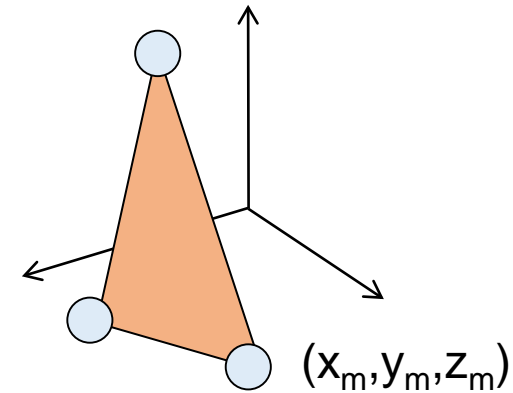
$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} \text{W2V} \\ \text{Persp} \\ \text{View} \\ \text{Model} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

# Vertex Pipeline

viewport (display)  
coordinates



model  
coordinates



$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} =$$

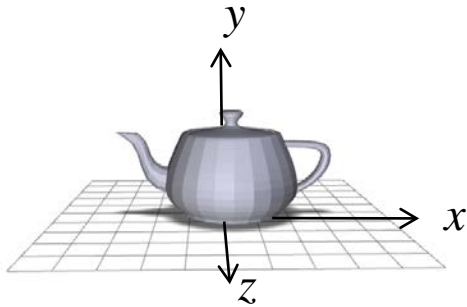
**M**

(not this simple in actual implementation)

$$\begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

# Transformation Order

```
glutSolidTeapot(1);
```



```
glRotate3f(-90, 0,0,1);  
glTranslate3f(0,1,0);  
glutSolidTeapot(1);
```



```
glTranslate3f(0,1,0);  
glRotate3f(-90, 0,0,1);  
glutSolidTeapot(1);
```



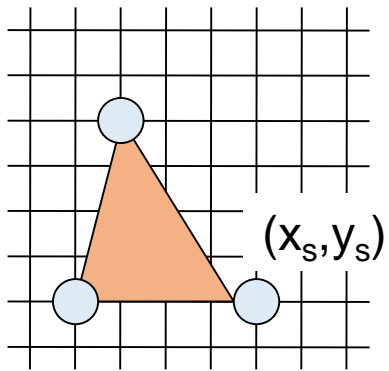
$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \mathbf{M} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \mathbf{M} \begin{bmatrix} \mathbf{R} \\ \mathbf{T} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

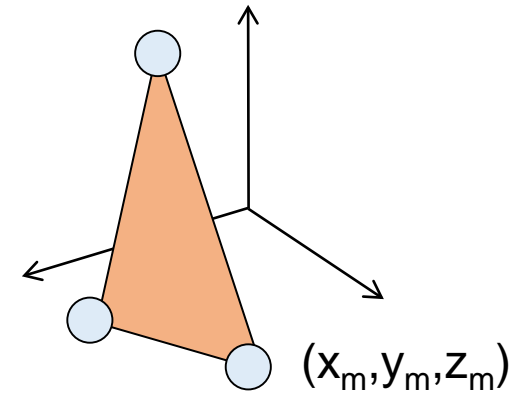
$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \mathbf{M} \begin{bmatrix} \mathbf{T} \\ \mathbf{R} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

# Vertex Pipeline

viewport (display)  
coordinates

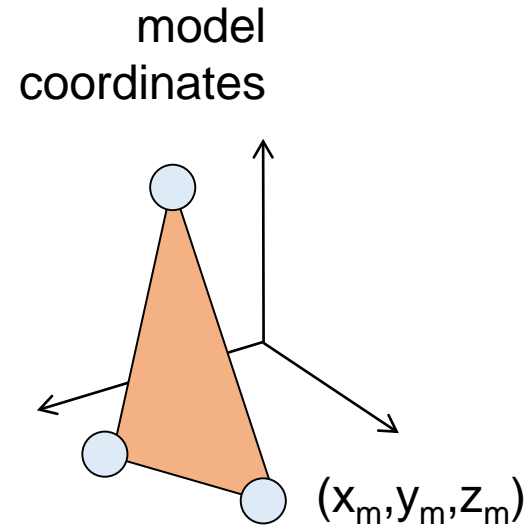
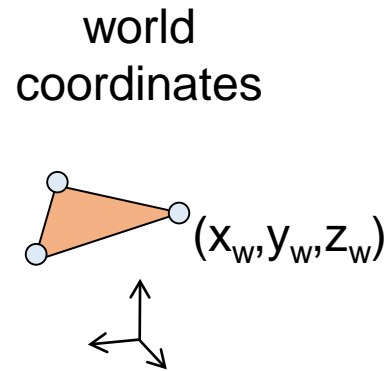
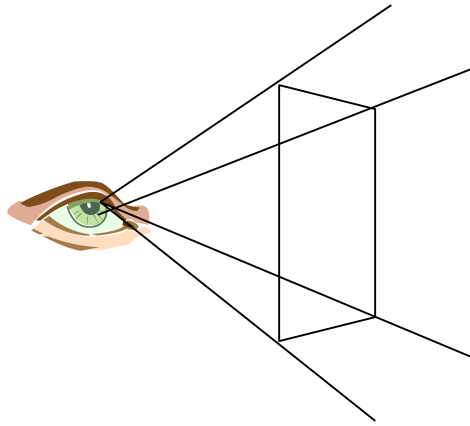


model  
coordinates



$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} \text{W2V} \\ \text{Persp} \\ \text{View} \\ \text{Model} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

# Viewing Transformation



$$\begin{bmatrix} x_s \\ y_s \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} \text{W2V} \\ \text{Persp} \\ \text{View} \\ \text{Model} \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ z_m \\ 1 \end{bmatrix}$$

# Viewing Transformation

