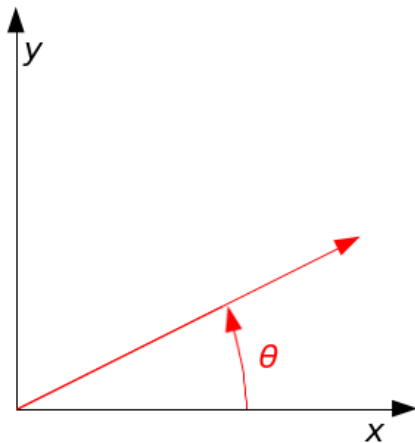


Explain the affine family of transformations.  
Explain the rotation and shearing.

Michel Donnet

## Principe of rotation



(source: wikipedia)

## Rotation matrix

$$\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$$

# Shearing

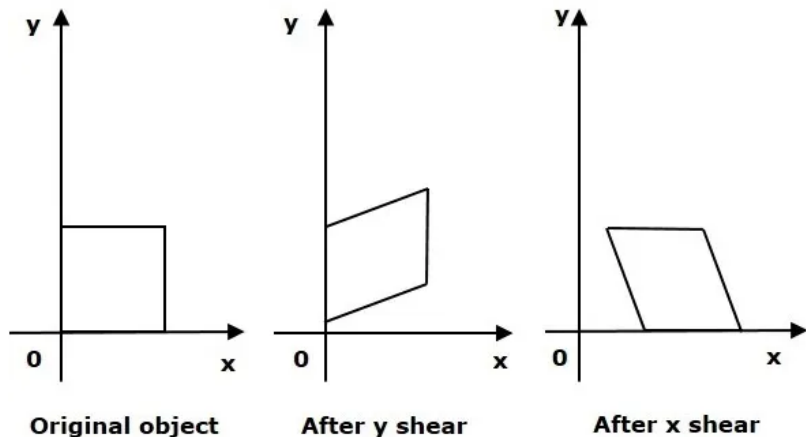


Figure 1: source: [tutorialspoint.com](http://tutorialspoint.com)

## Shearing: matrix

x shearing:

$$\begin{aligned}x &= w + bz \\ y &= z\end{aligned}$$

$$\text{Matrix for shearing} = \begin{bmatrix} 1 & b \\ c & 1 \end{bmatrix}$$

## Note

Interpolation is necessary because we are in a discrete space.

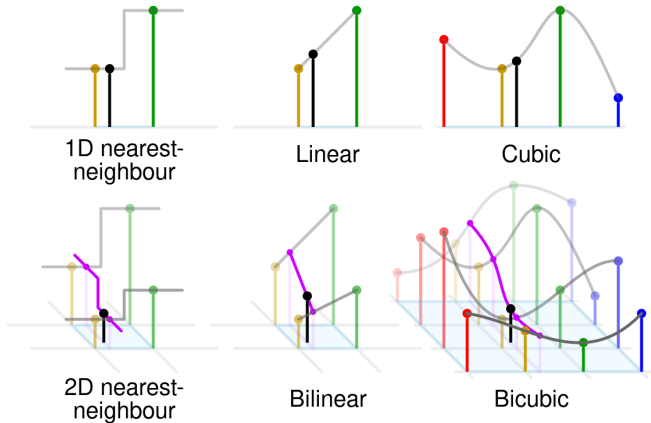


Figure 2: source: wikipedia