Mu Sigma

Thursday Learning Hour

Math Series: Introduction to Linear Algebra- Session 1

Do The Math

Chicago, IL
Bangalore, India
www.mu-sigma.com

8th September 2022

Basic geometric transformation

- Turn
- Flip
- Slide
- Resize
- Shear

You know Mathematicians are funny people

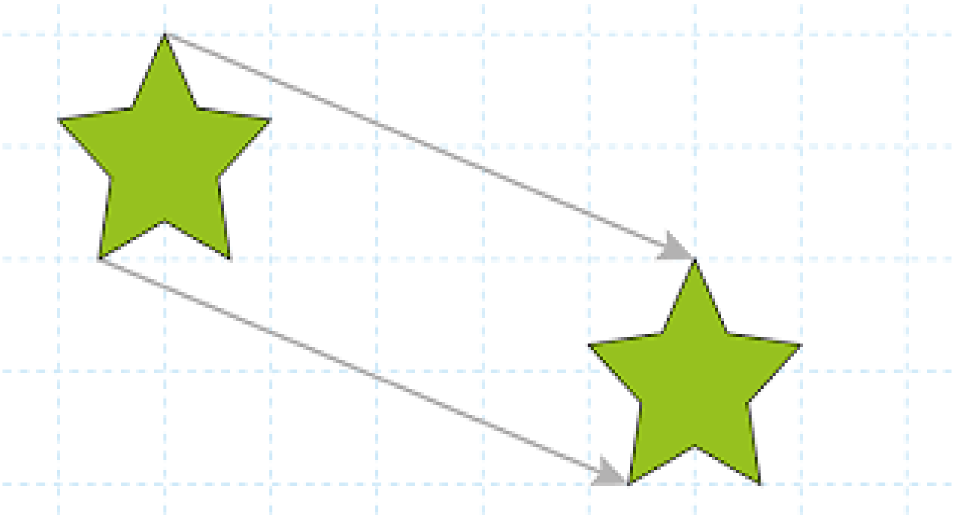
Turn	Rotate
Flip	Reflection
Slide	Translation
Resize	Dilation
Shear	Skew

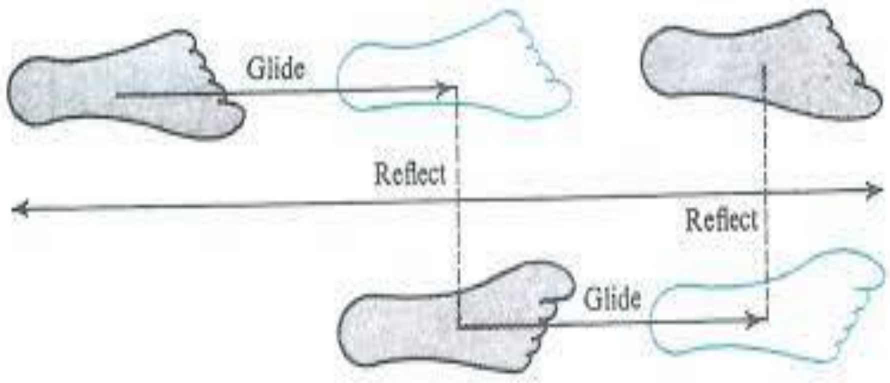
Quiz - name the geometric transformation

Quiz - name the geometric transformation

Quiz - name the geometric transformation

What is this?





Basic transformations can be represented in a matrix form

1. Scaling $\begin{bmatrix} S_x & 0 \\ 0 & S_y \end{bmatrix}$

2. Rotation (clockwise) $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

3. Rotation (anti-clock) $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$

4. Translation $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ t_x & t_y \end{bmatrix}$

5. Reflection (about x axis) $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

6. Reflection (about y axis) $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$

7. Reflection (about origin) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$

8. Reflection about Y=X $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

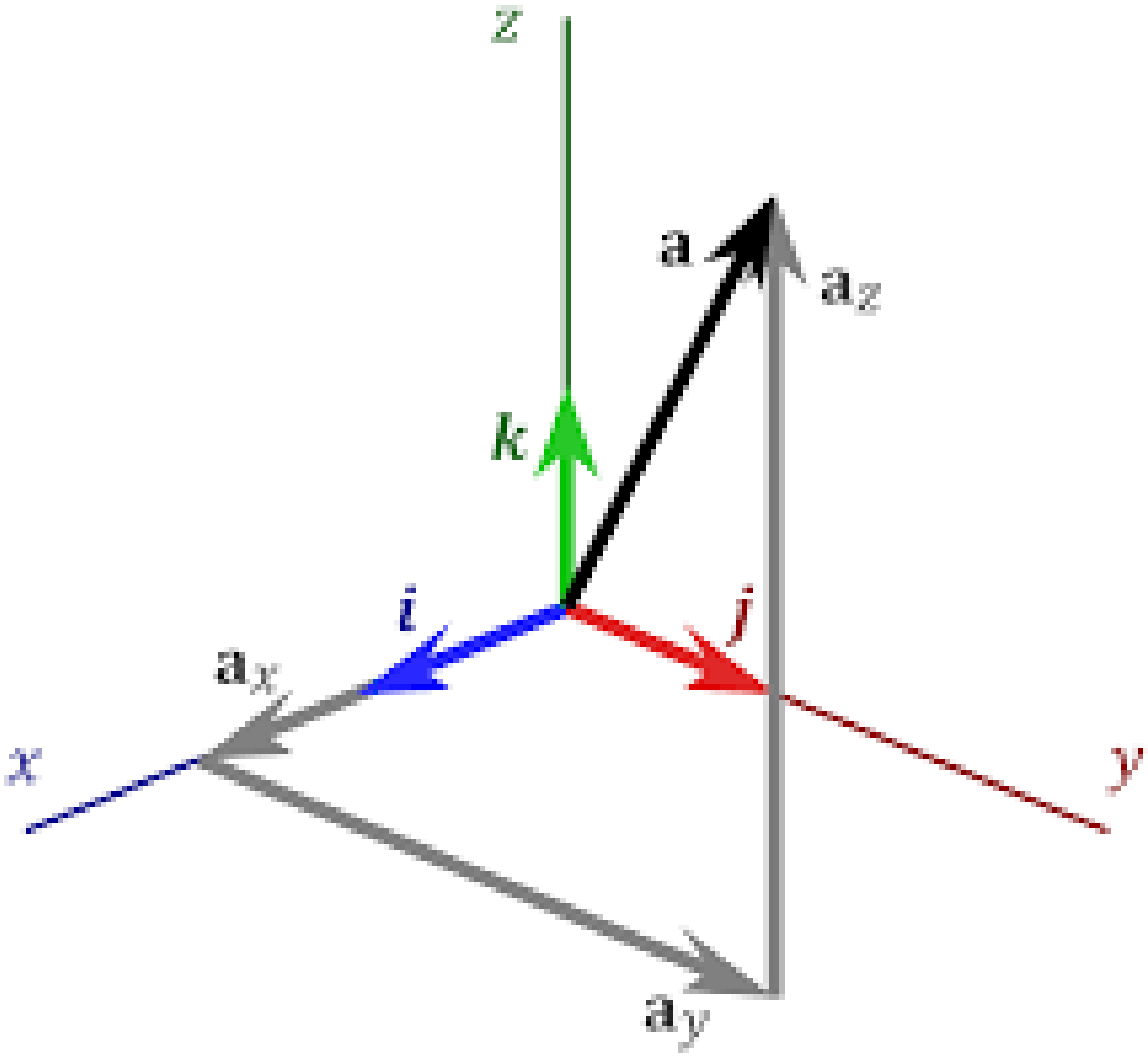
9. Reflection about Y= −X $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

10. Shearing in X direction $\begin{bmatrix} 1 & 0 \\ Sh_x & 1 \end{bmatrix}$

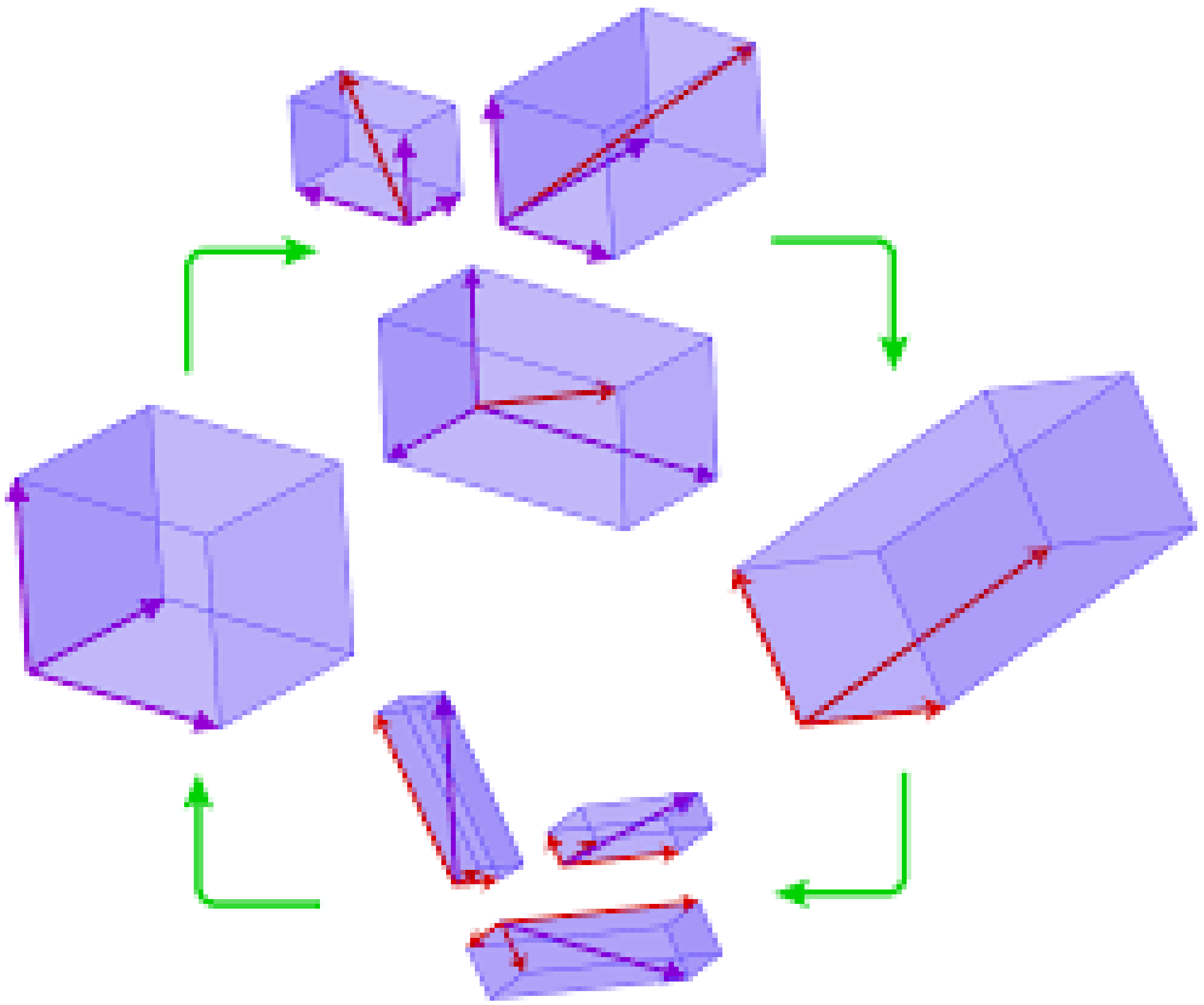
11. Shearing in Y direction $\begin{bmatrix} 1 & Sh_y \\ 0 & 1 \end{bmatrix}$

12. Shearing in both x and y direction $\begin{bmatrix} 1 & Sh_y \\ Sh_x & 1 \end{bmatrix}$

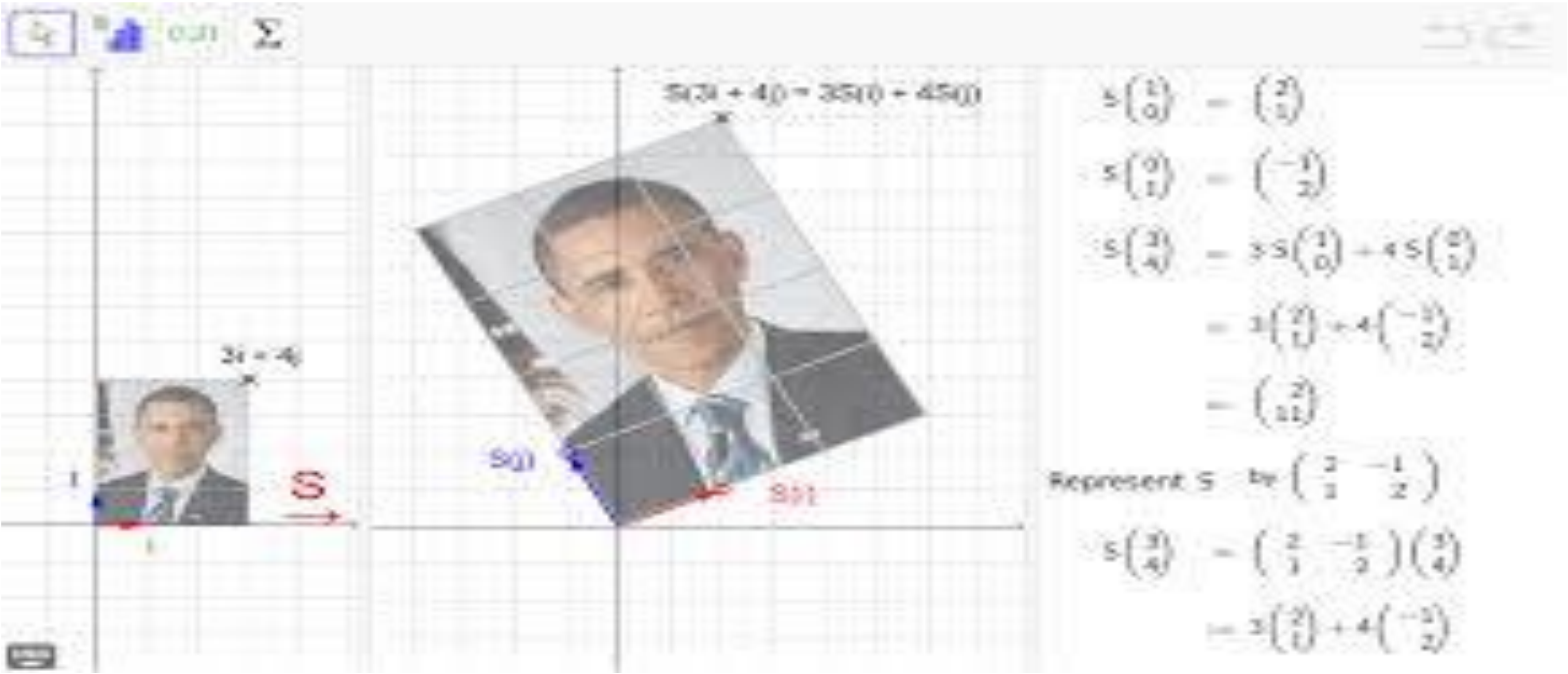
Unit vectors along pairwise mutually perpendicular standard x-, y-, z-axes are called standard basis

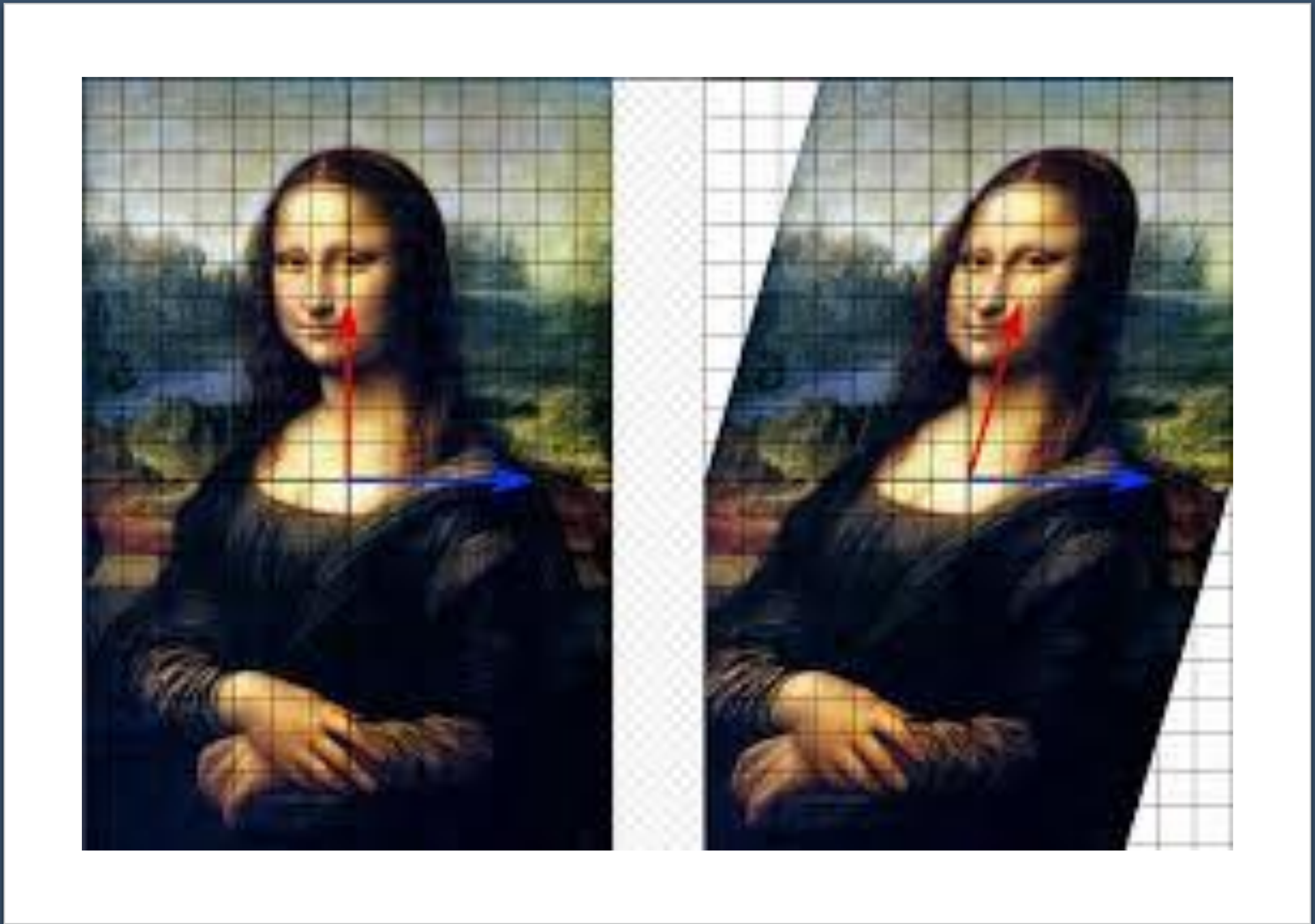


Change of Basis



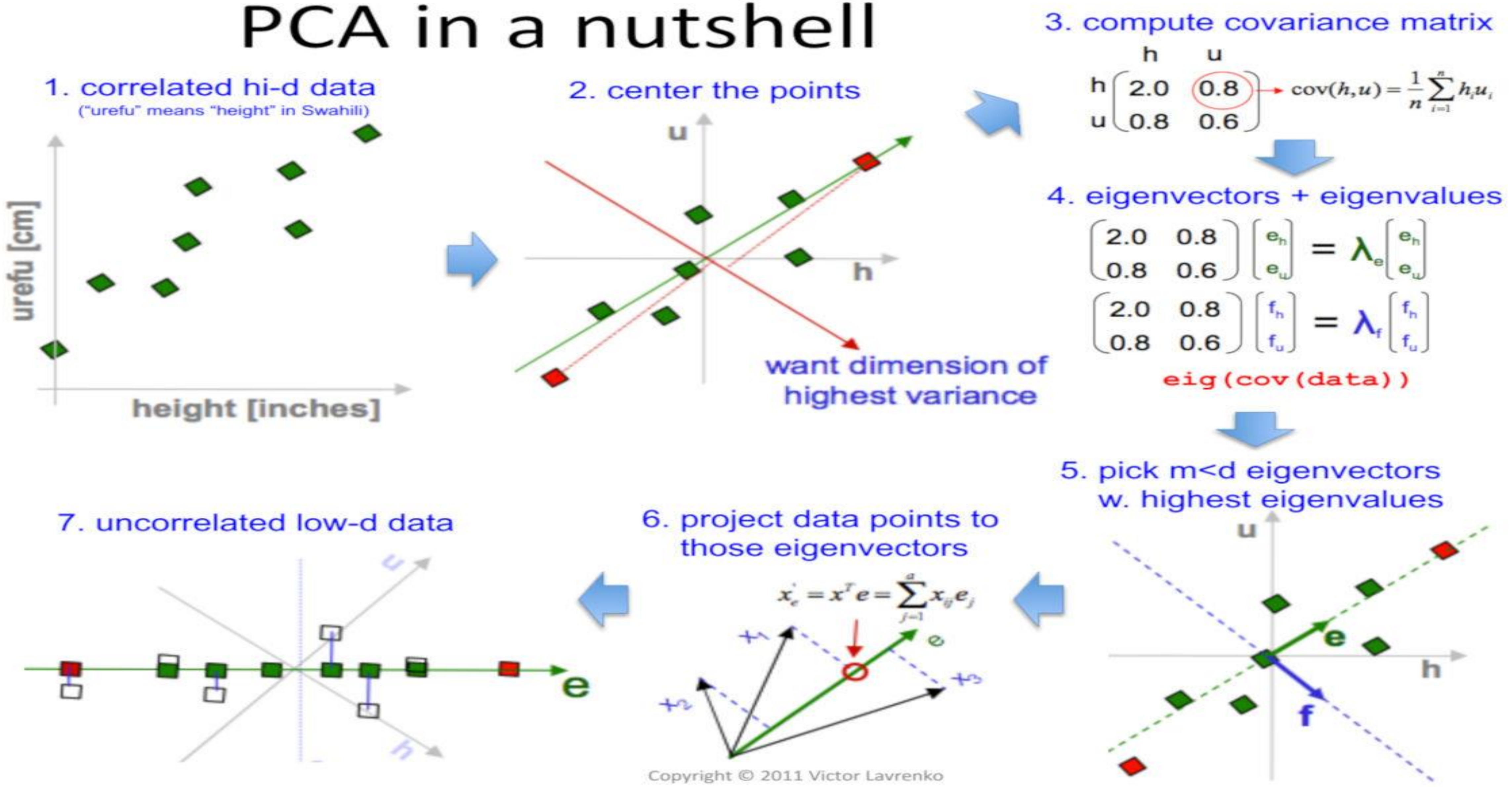
Linear transformation





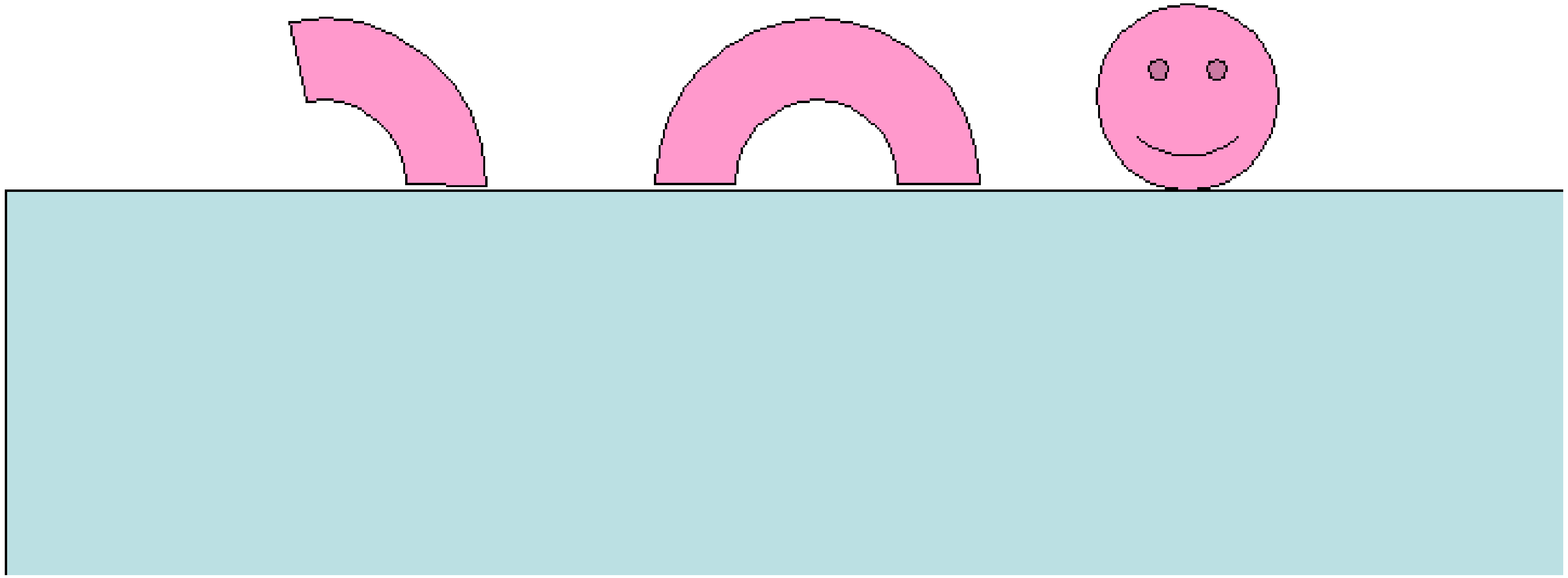
Linear transformation changes the axis too except for eigen vectors.

PCA in a nutshell



Factor Analysis

How many animals are under the water?



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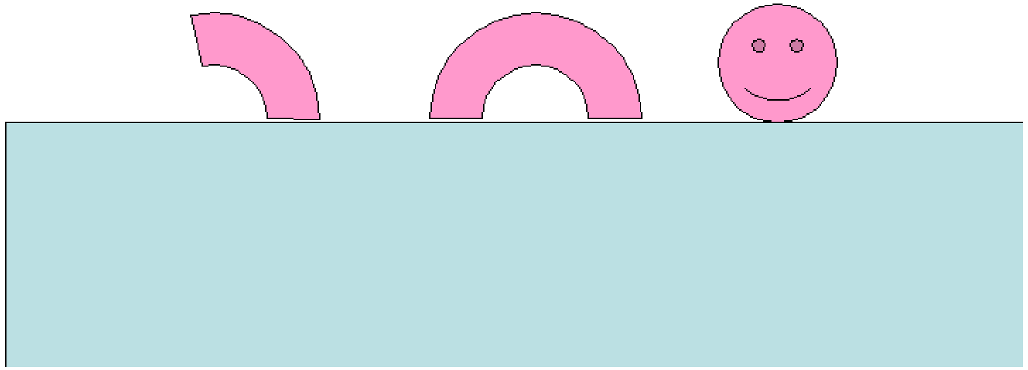

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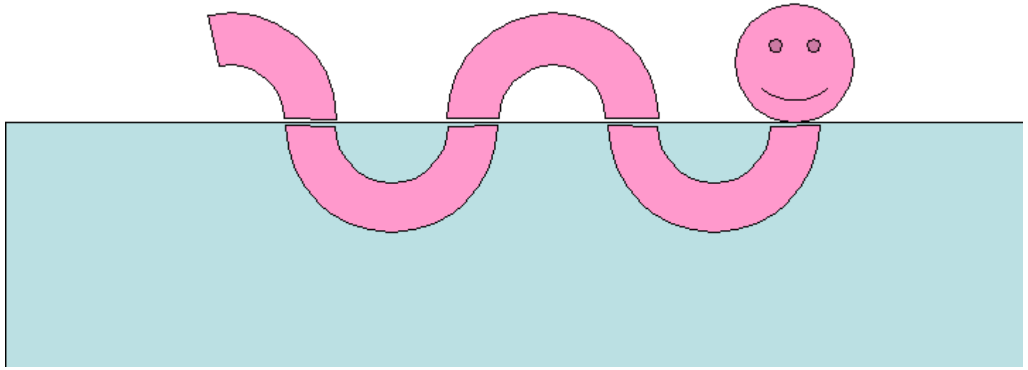
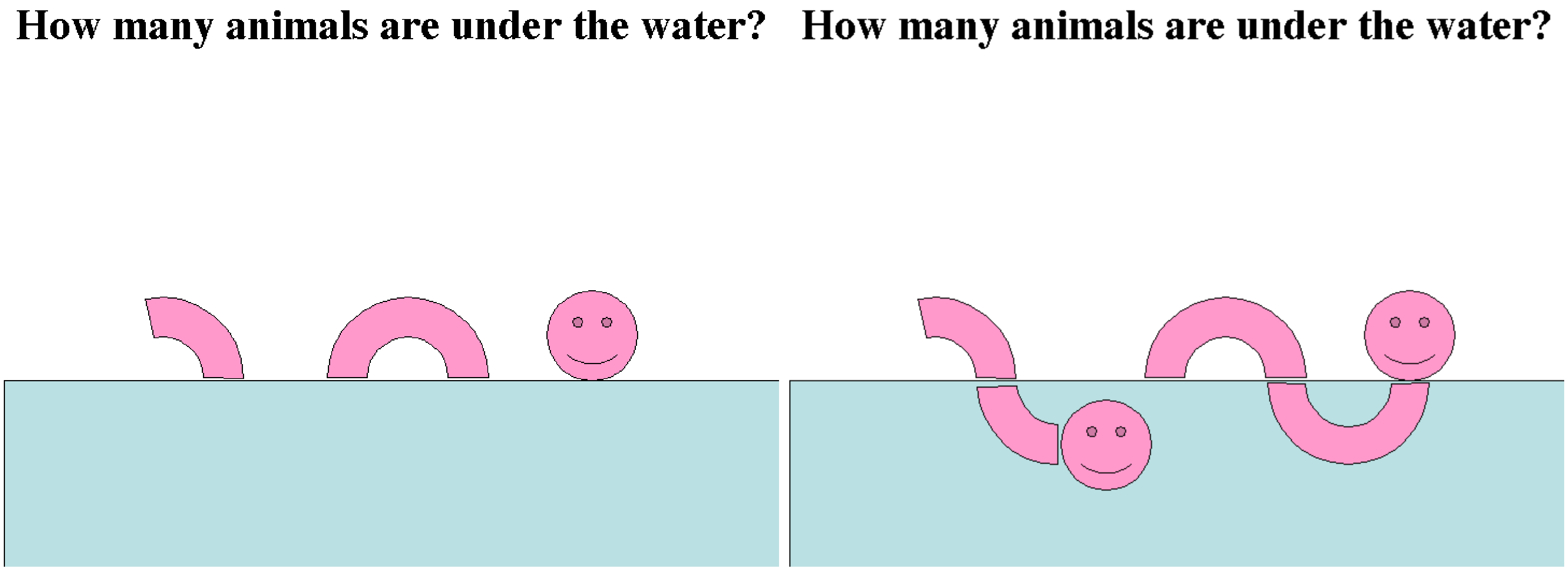
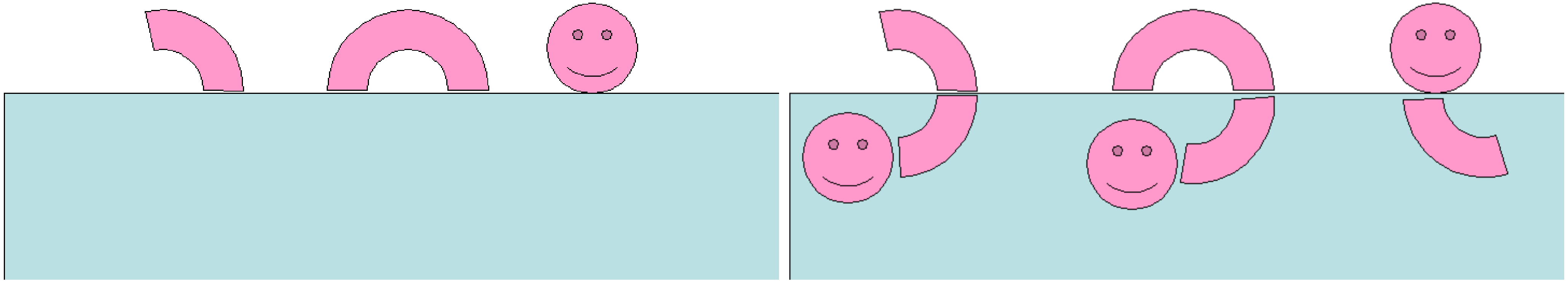


Factor Analysis

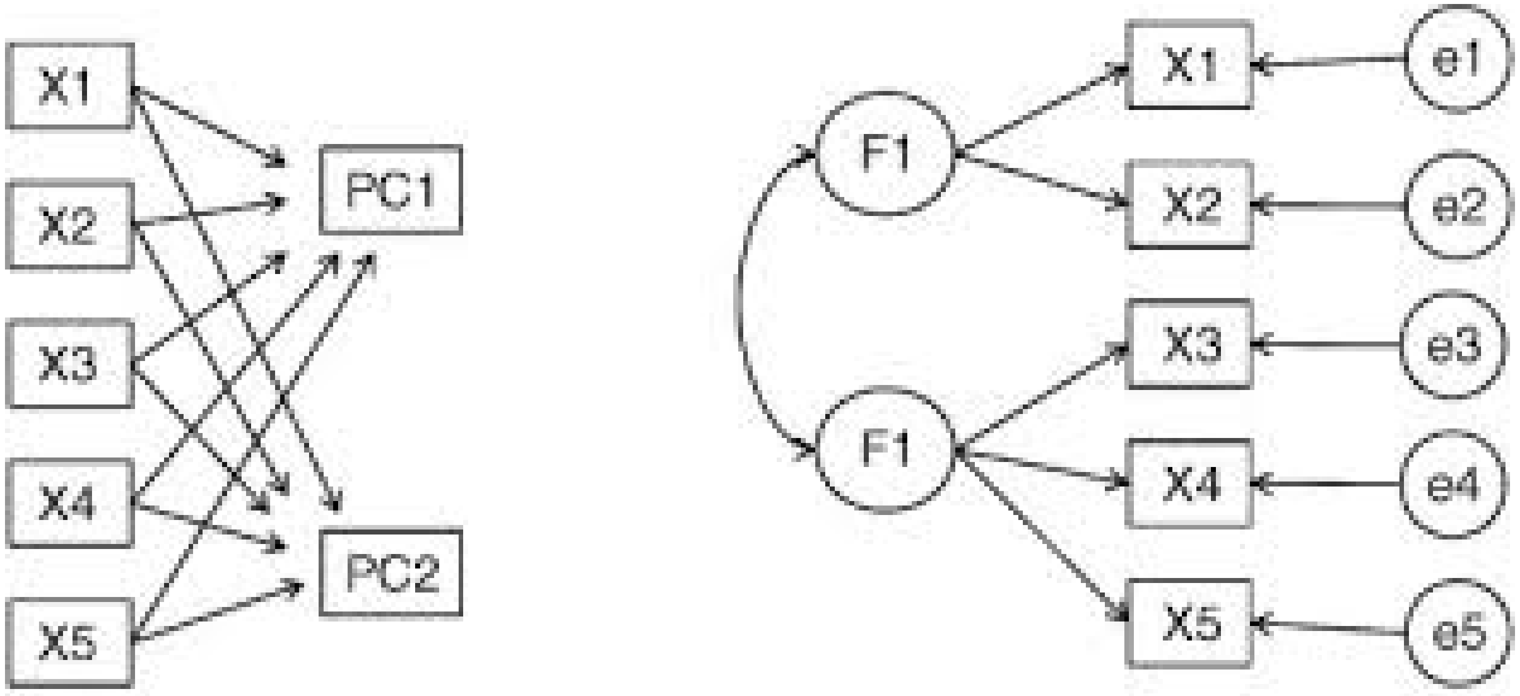


Factor Analysis

How many animals are under the water? **How many animals are under the water?**



PCA Vs Factor Analysis



(a) Principal Components Model

(b) Factor Analysis Model

Thank You