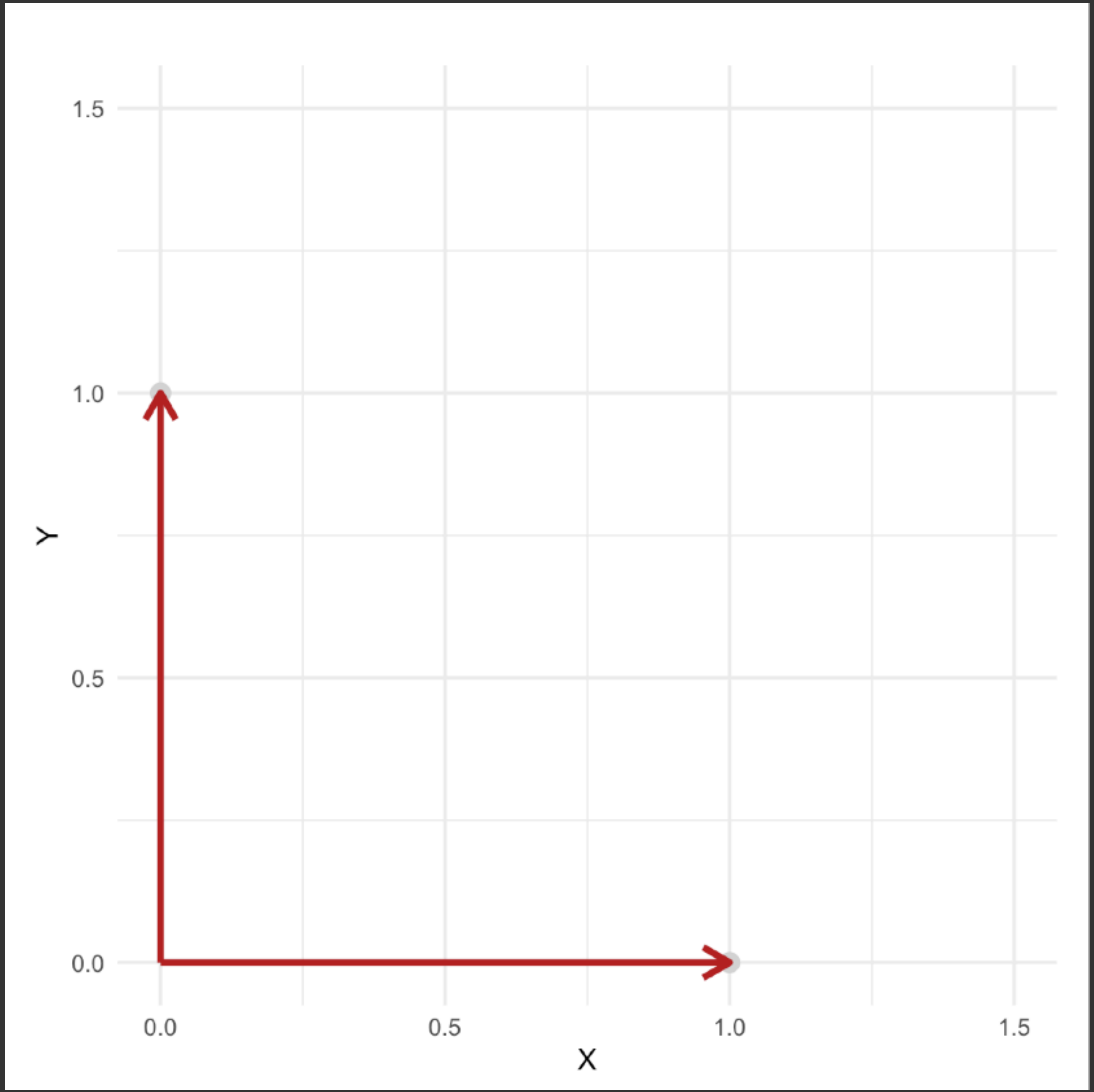
example



- $\vec{x}$ and $\vec{y}$ are unit vectors in the direction of the coordinate axes
- We are used to representing all vectors in $\mathbb{R}^2$ as linear combinations of these vectors
- We can actually choose any 2 linearly independent vectors in $\mathbb{R}^2$ as basis vectors
- However, an orthogonal basis is the most convenient basis that one can hope for.

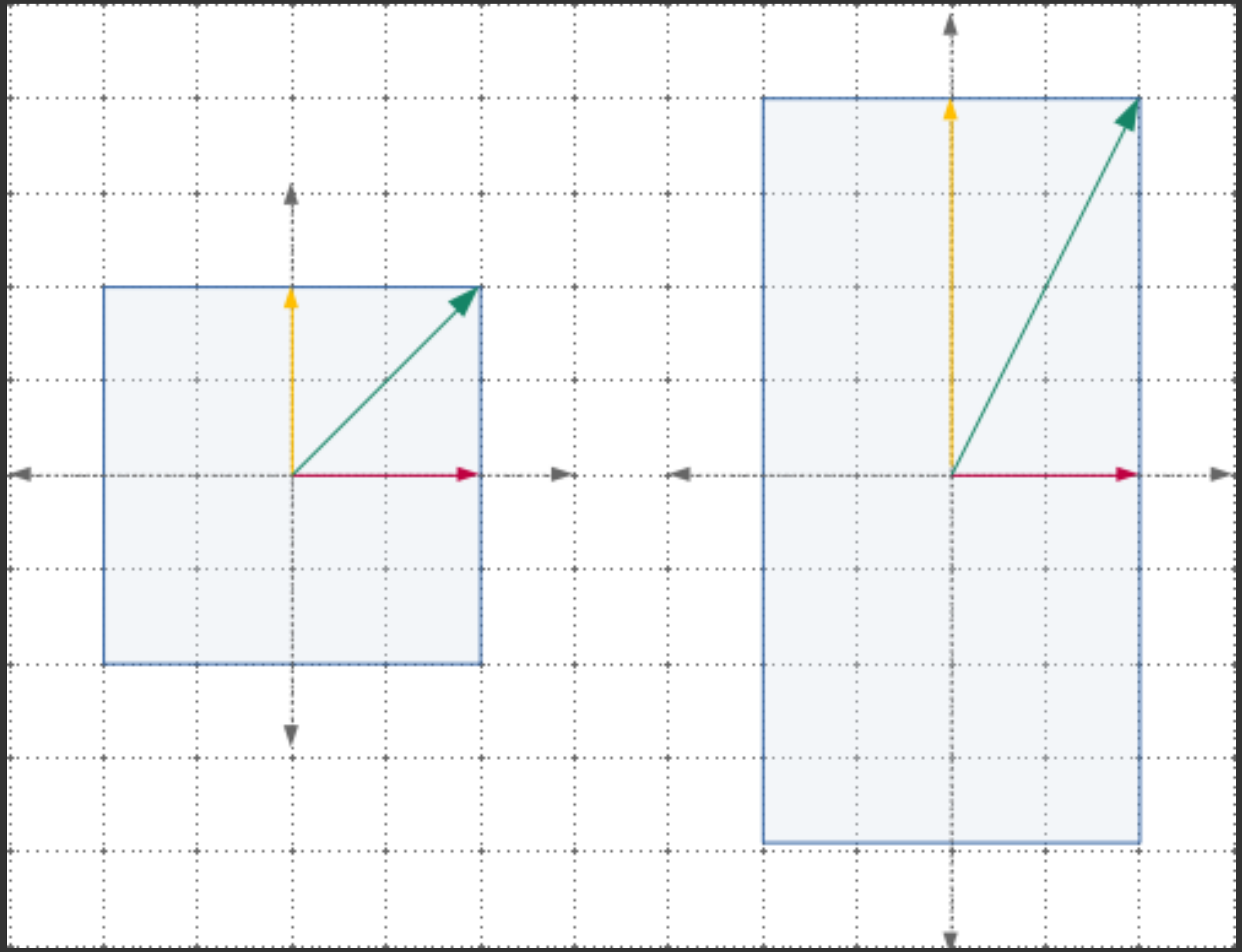
what has all this got to do with eigenvectors?

eigenvectors and eigenvalues: intuitively

example

Applying a vertical scaling of +2 to every vector of a square, will transform the square into a rectangle.

- The horizontal vector remains unchanged (same direction, same length).
- The vertical vector has same direction, but doubled in length.
- The diagonal vector has changed its angle (direction) as well as length.



After vertical scaling of +2, every vector's direction has changed, except the horizontal and vertical ones.

These two vectors are special and are the characteristic of this particular transform. They are called eigenvectors

The eigenvalue is how much the eigenvectors are transformed (**stretched or squished**).

- The horizontal vector's length remains same, thus have an eigenvalue of +1.
- The vertical vectors' length doubled, thus have an eigenvalue of +2.