The Magnitude of the Correlation Coefficient

Theme

Part 1: Noise Influence

- Increase of σ_y: r_{XY} decreases but the linear relationship is still present
- Increase of σ_x: same as for σ_y, only in the x-direction
- Increase both: this decreases r_{XY} even more but the linear relationship is not present anymore. Only Gaussian noise is visible

Part 2:

The underlying cause here is how the regression line is calculated: it measures the difference between the points and the corresponding y-intercept on the line, i.e. the dependency from X (independent variable) to Y (dependent variable).

- When we increase σ_x, the points scatter around more to the right and left which leads to a new fit for the regression line.
- When we increase σ_y, the points scatter mainly up and down. This does only increase the distance to the y-intercept but the regression line itself stays roughly the same.

If we changed the plot axes, the effects would reverse.

Code