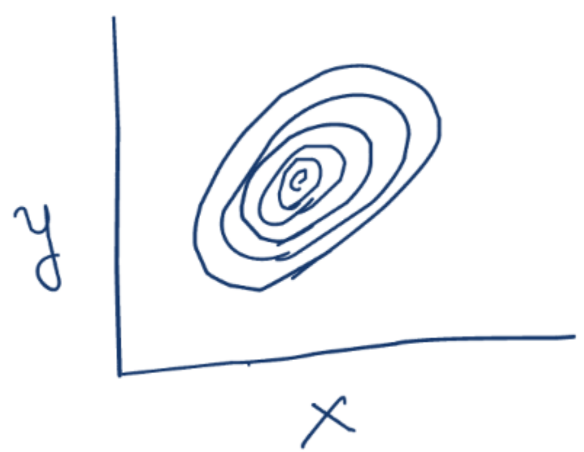
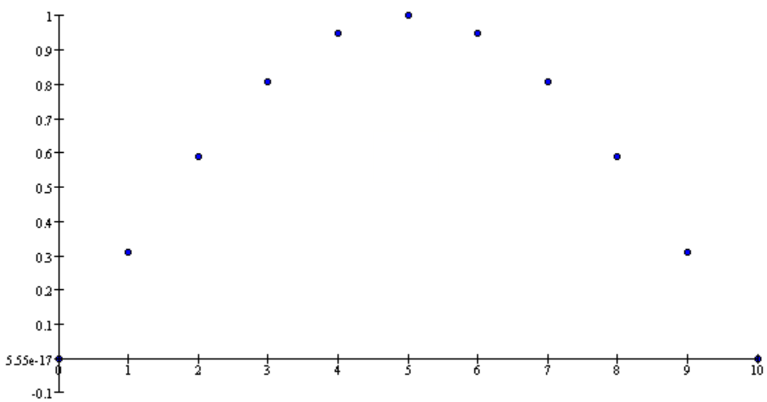
<u>Assumptions:</u>

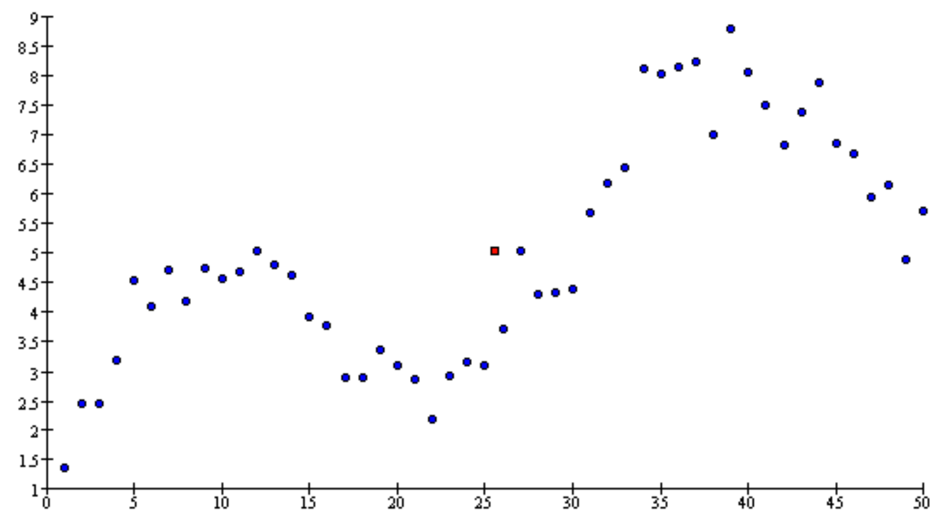
- Random sample
- Linearity
- Correlation <u>depends on range of values</u>
- Homoscedastic variances
- **Bivariate Normal Distribution**
    - X is normally distributed
    - Y is normally distributed
    - X and Y have linear relationship



Non-linearity:

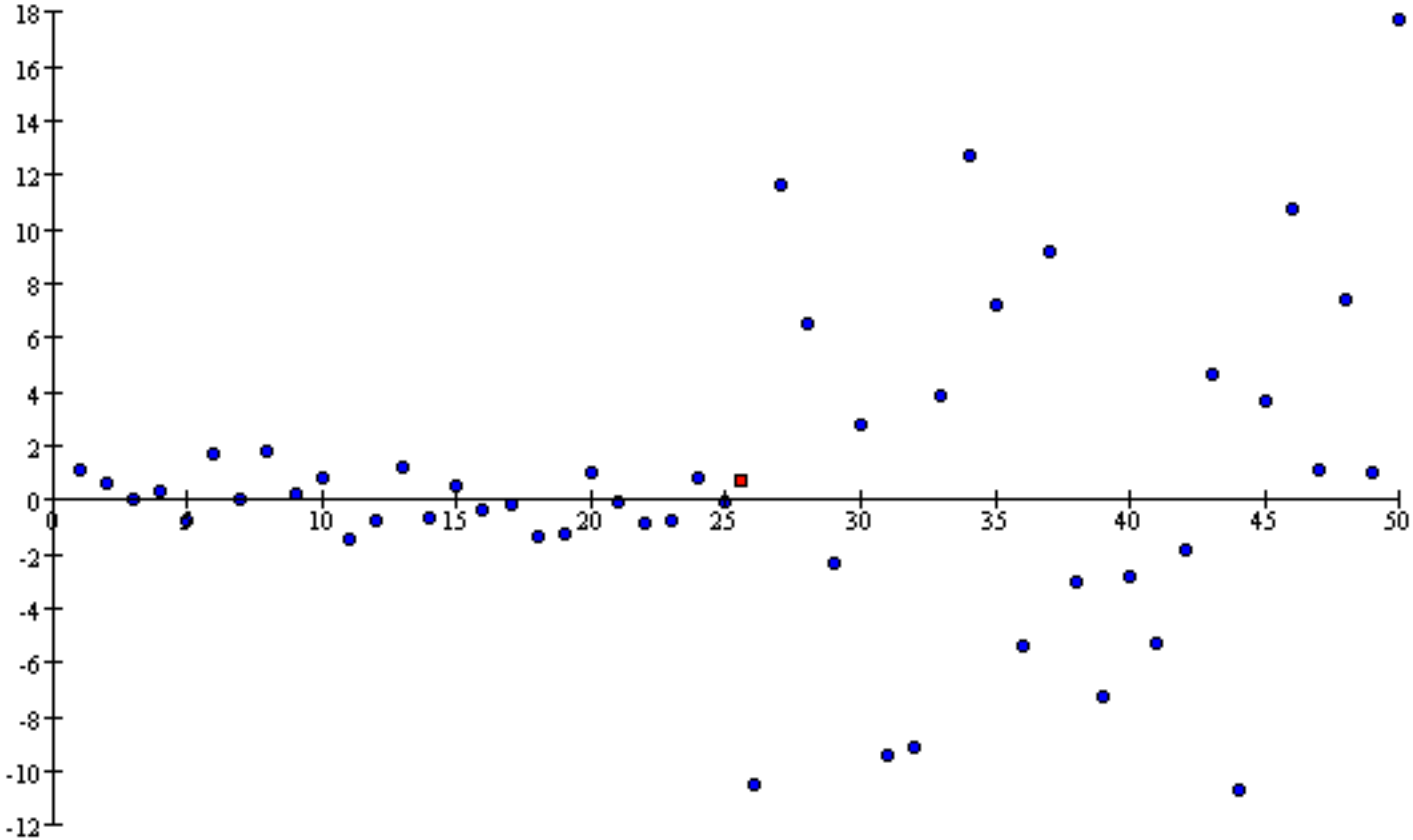


r = 0

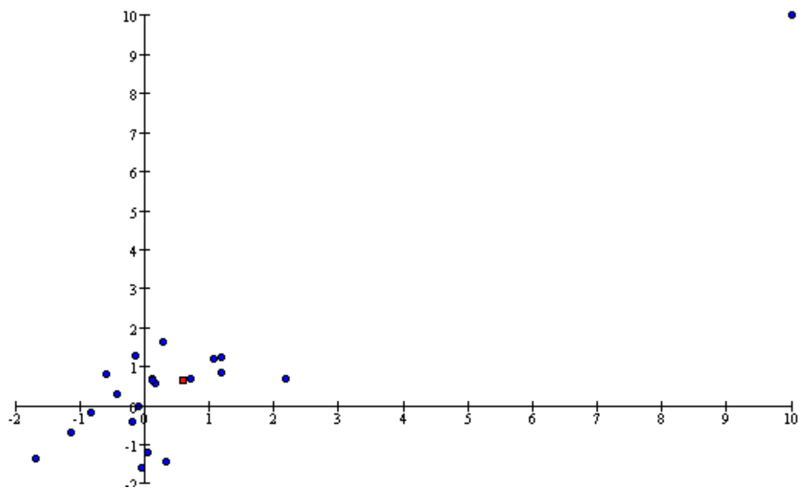


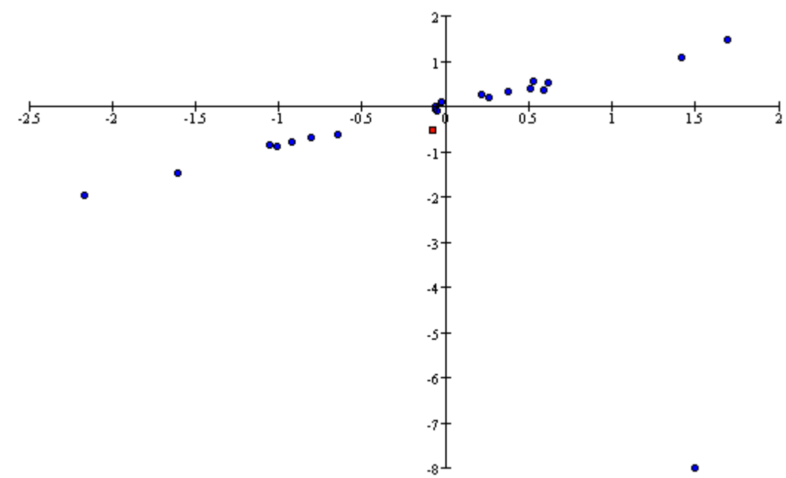
r = 0.71

Heteroscedasticity:

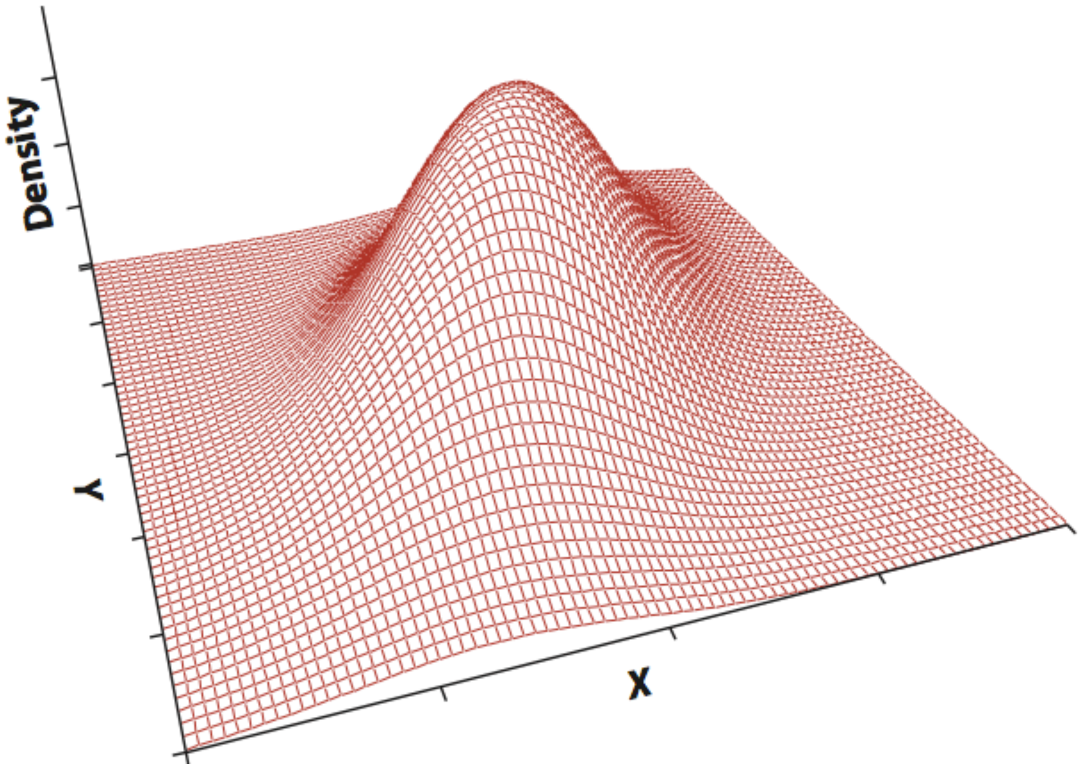


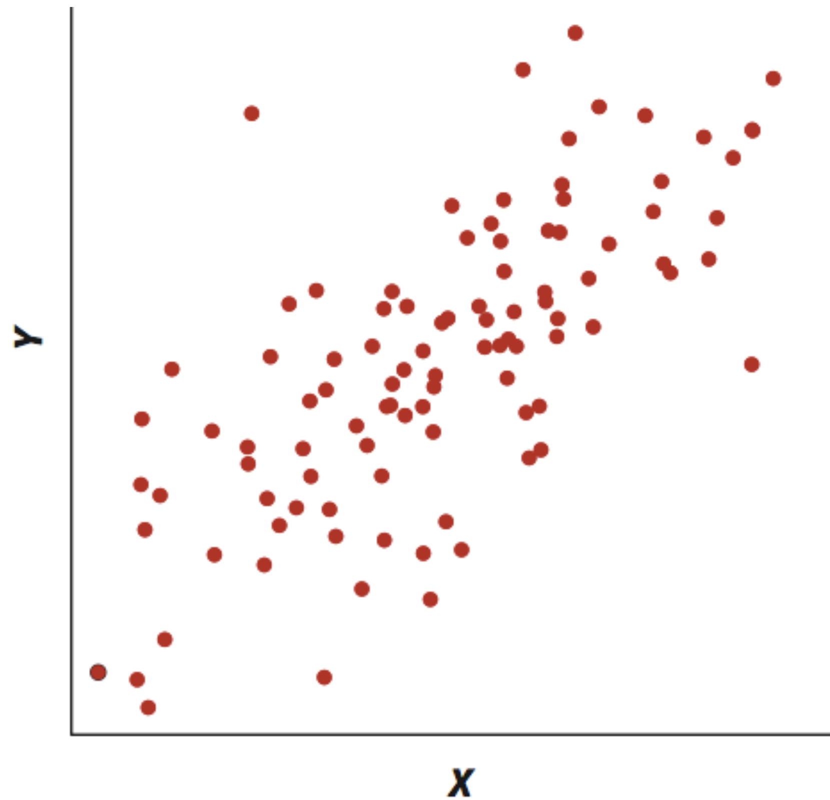
Outliers:


10
9
8
7
6
5
4
3
2
1
0
-1
-2
-2
-1
0
1
2
3
4
5
6
7
8
9
10


2
1
-1
-2
-3
-4
-5
-6
-7
-8
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

This is what **bivariate** looks like:





If data are not bivariate or are not linearly related try **transformation** of data.

If data are heteroscedastic or have outliers… try a **non-parametric method**…..

- Remember: non-parametric methods are more conservative (they have less power) than parametric

Spearman's rank

<u>assumes:</u>

* random sample

* linear relationship

- Spearman's rank correlation:
  - Measures strength and direction of linear association between the **ranks** of two variables
  - Two variables are ranked separately
  - Parameter: ρ_s; sample estimate: r_s

- <u>Spearman's rank correlation:</u>

Test for correlation in the normal way….

Step 1: declare null and alternate

H_0: Zero correlation (ρ_s=0)

H_A: Some correlation ($\rho_s \neq 0$)

Step 2: test statistic

$$\boxed{r_s = \frac{\sum (R-\bar{R})(S-\bar{S})}{\sqrt{\sum (R-\bar{R})^2}\sqrt{\sum (S-\bar{S})^2}}}$$

Step 3:State α/P-value/Critical value

Table G

Step 4: State conclusion

If n > 100:

$$t = \frac{r_s - \rho_s}{SE_{r(s)}}$$

– where:

$$\boxed{SE_{r_s} = \sqrt{\frac{1 - r_s^2}{n - 2}}}$$

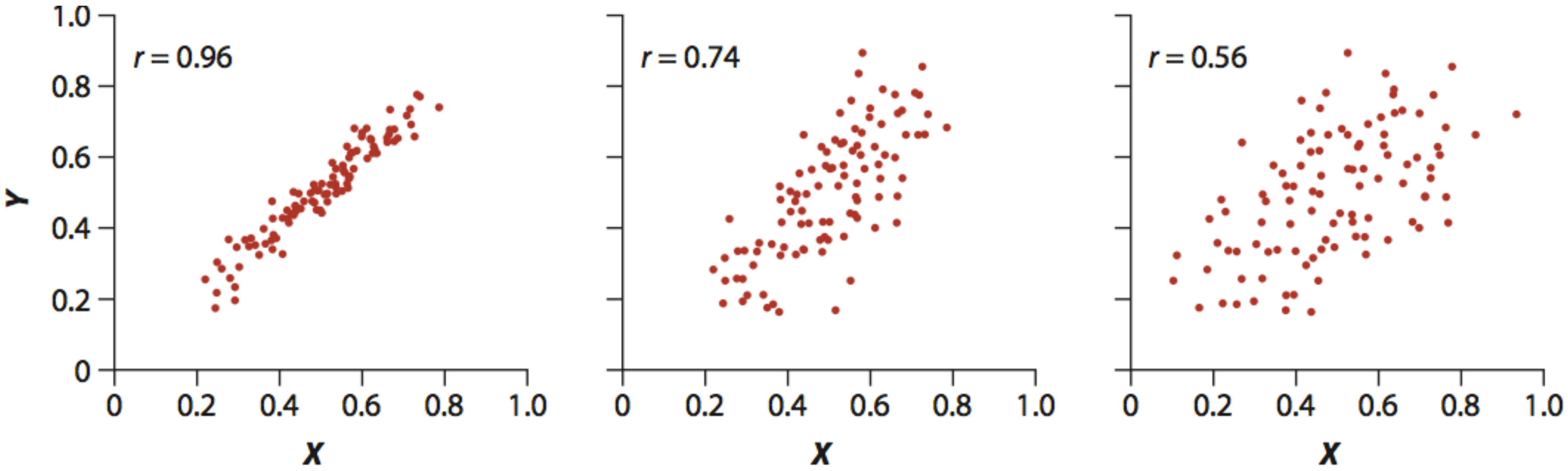
– t is ~*t*-distributed with n - 2 degrees of freedom

– Tricky part: reject null hypothesis if

- $t \geq t_{0.05(2),n-2}$
- $t \leq -t_{0.05(2),n-2}$

Attentuation

- measurement error weakens correlation

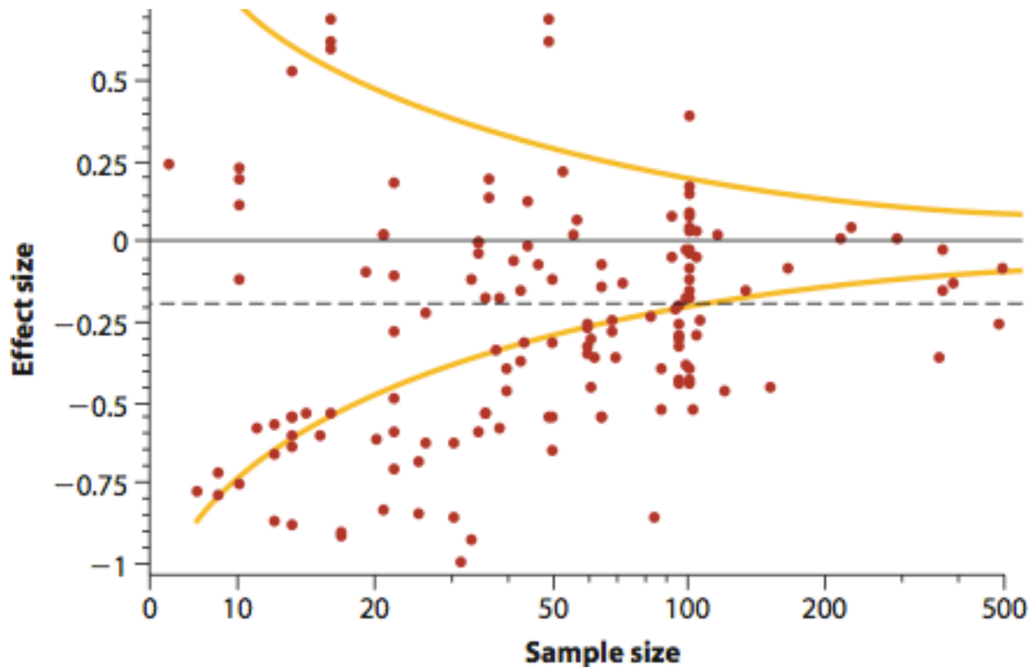


Publication Bias

Papers that:

- Reject null
- Have large effect

tend to be published



http://www.badscience.net/about-dr-ben-goldacre/