

Significance

and

Errors

Recap: Statistical significance

A p-value of 0.05 or below is conventionally called “statistically significant”

A p-value of 0.01 or below is conventionally called “highly statistically significant”

CAUTION: These thresholds are arbitrary

Significance levels

The threshold below which the p-value is deemed small enough to reject the null hypothesis

If p-value $< \alpha$, then reject H_0

If p-value $\geq \alpha$, then reject H_0

If the p-value is small...

Reject H_0

The sample would be extreme if H_0 were true

The results are statistically significant

We have evidence for H_a

If the p-value is not small...

Do not reject H_0

The sample would not be too extreme if H_0 were true

The results are not statistically significant

The test is inconclusive: either H_0 or H_a may be true

Why can't we accept H_a ?

For the logical fallacy of believing that a hypothesis has been proved to be true, merely because it is not contradicted by the available facts, has no more right to insinuate itself in statistical than in other kinds of scientific reasoning...

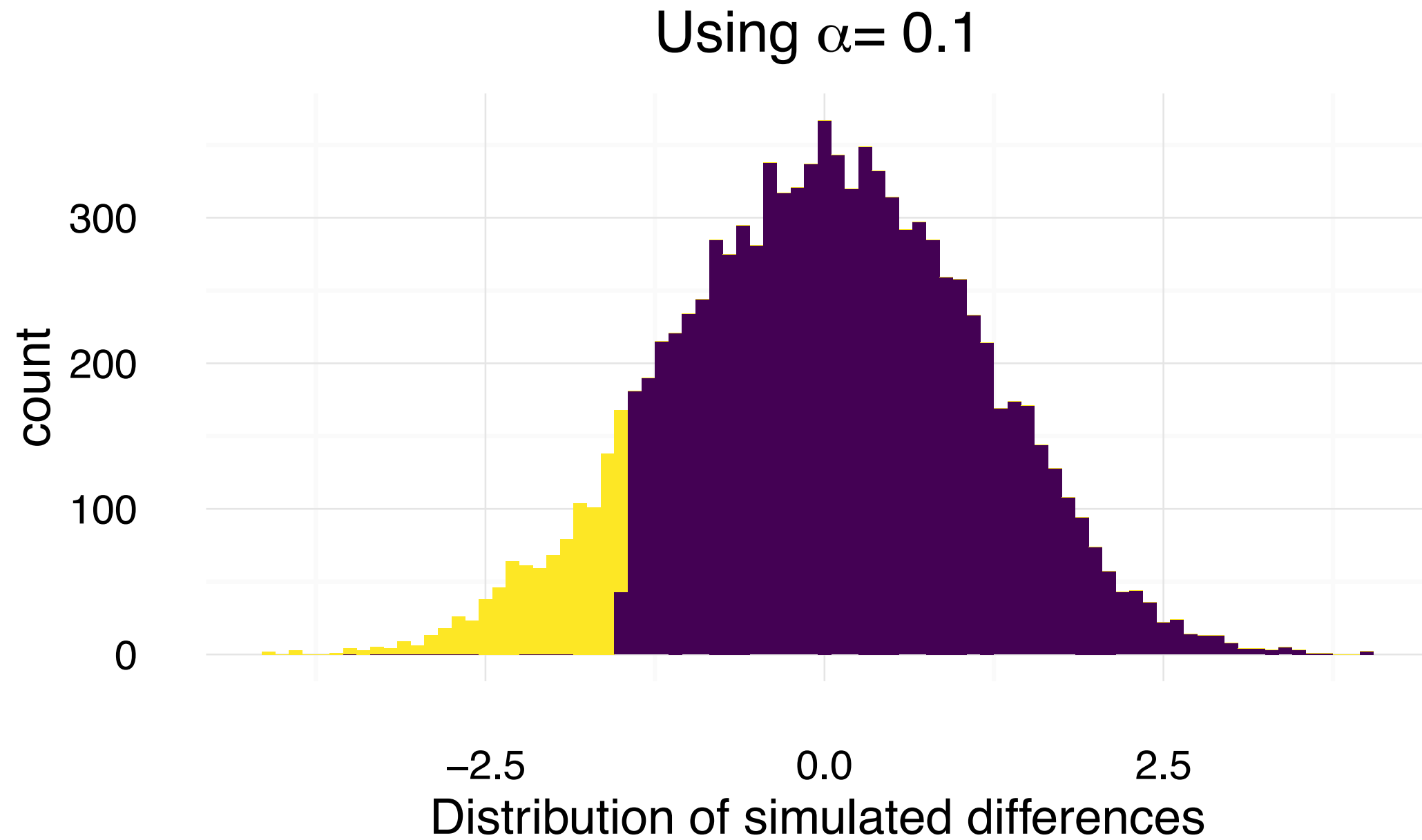
— R.A. Fisher

Statistical

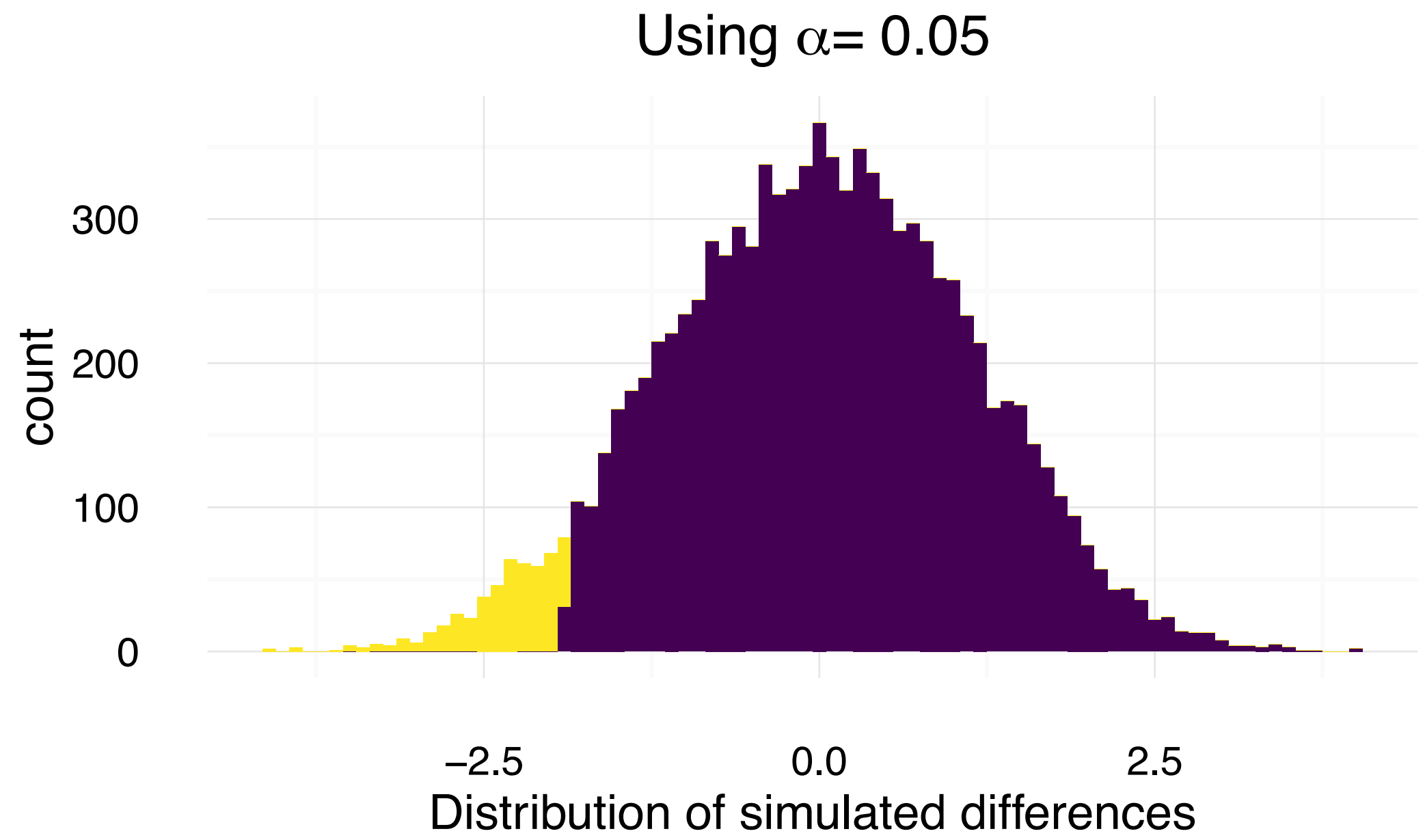
Errors

Two types of errors

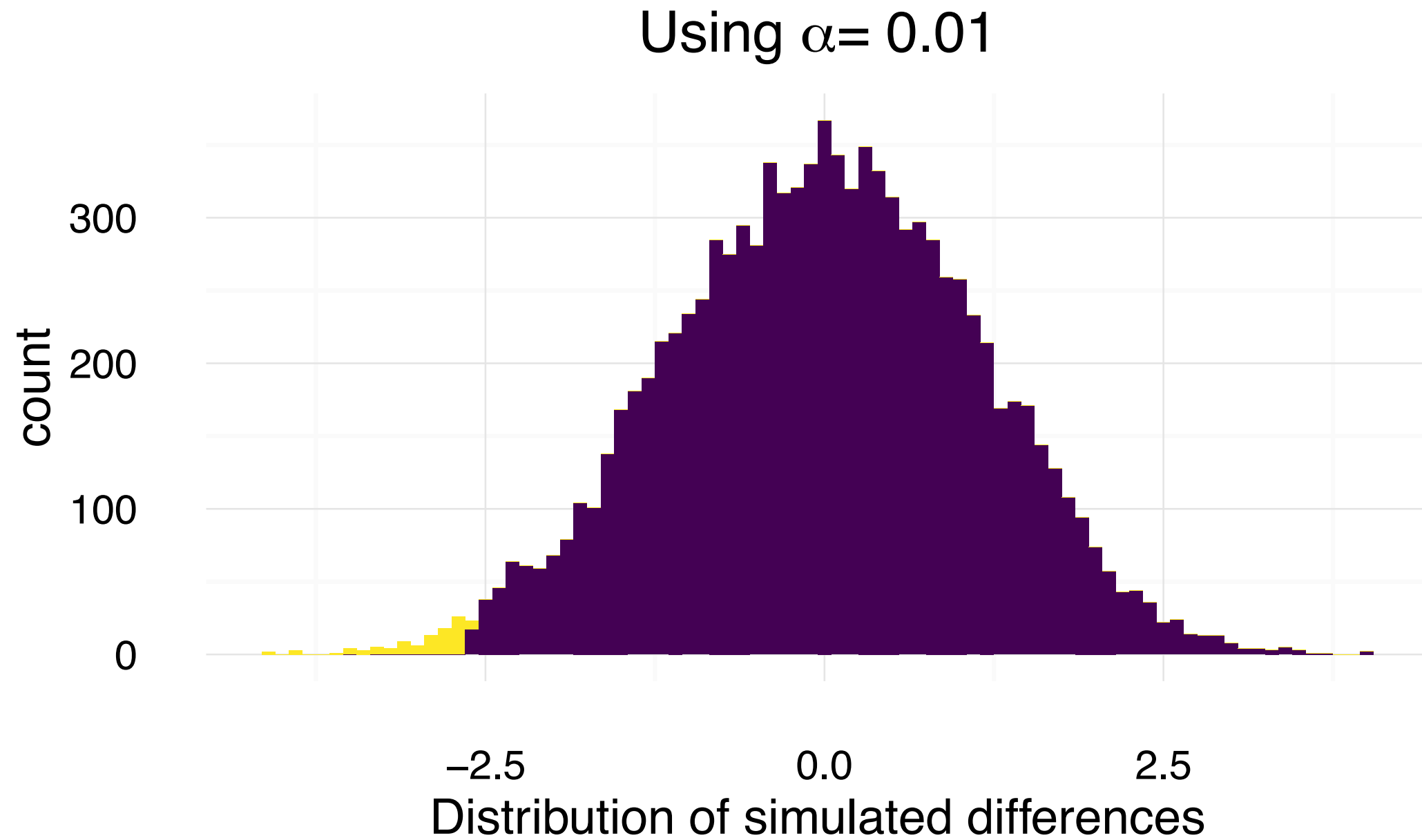
Probability of a Type I error



Probability of a Type I error



Probability of a Type I error



How to set the significance level

Consider which type of error is worse

If a Type I error is much worse, then set α lower

If a Type II error is much worse, then set α higher

**CAUTION: Statistically
significant results are not
required to be practically
significant**