

Type I & Type II Errors

Mathematics

The two ways a test can be wrong, and the trade-off between them.

Type I error

- Rejecting a null hypothesis that is true
- A false positive
- Its probability is α , the level you set
- Controlled directly by your choice of α
- Lowering α makes it rarer
- The error a sceptic worries about

Type II error

- Failing to reject a false null hypothesis
- A false negative
- Its probability is β
- Power is $1 - \beta$
- More data or a larger effect raises power
- The error an optimist worries about

THE DIFFERENCE THAT MATTERS

For a fixed sample size, lowering α raises β . Only more data improves both at once.

Power depends on effect size, α , variability and n . Once a study is designed, n is the only one still under your control. Educational