What Confidence Means

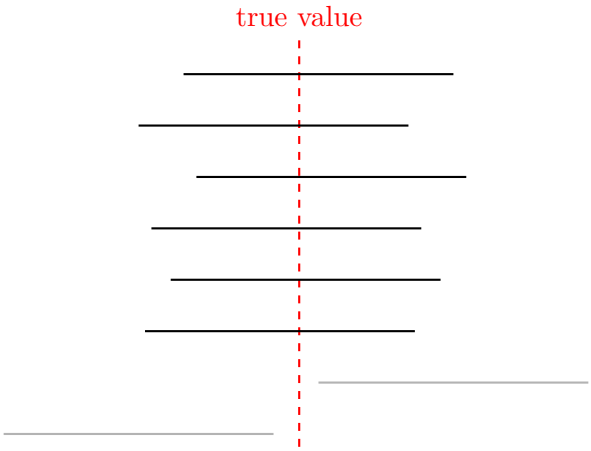
AP Statistics

A confidence interval is often misinterpreted as assigning probability to the parameter. This page explains why that interpretation is incorrect and what confidence actually means.

What is random? What is fixed?

- The parameter (the true value) is fixed but unknown.
- The sample is random.
- The confidence interval is random because it is calculated from the sample.

Confidence describes the long–run behavior of the interval–construction method, not the probability that a fixed parameter lies in one specific interval.



Most intervals cross the true value; a few do not. This picture represents repeated random sampling.

Incorrect: "There is a 95% chance that the parameter lies in this interval."

Once the data are collected:

- the interval is fixed,
- the parameter is fixed,
- so the parameter is either inside the interval or not.

The probability is therefore 0 or 1, not 0.95.

A 95% confidence interval means that if we repeatedly take random samples and build intervals using this method, about 95% of those intervals will contain the true parameter.

One–sentence takeaway:

The parameter is fixed; the interval varies from sample to sample.

Note. In Bayesian statistics, probability statements about parameters are meaningful, but confidence intervals use a different framework.