

# Design and Analysis of Experiments

## 04 - Statistical Intervals

Version 2.11

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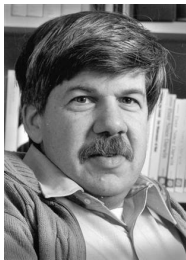
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*“Science is an integral part of culture. It’s not this foreign thing, done by an arcane priesthood. It’s one of the glories of the human intellectual tradition.”*

Stephen Jay Gould  
1941-2002  
American paleontologist



# Statistical Intervals

## Introduction

Statistical intervals are important in quantifying the uncertainty associated to a given estimate;

As an example, let's recap the coaxial cables example: *a coaxial cable manufacturing operation produces cables with a target resistance of  $50\Omega$  and a standard deviation of  $2\Omega$ . Assume that the resistance values can be well modeled by a normal distribution.*

Let us now suppose that a sample mean of 25 observations of resistance yields  $\bar{x} = 95$ . Given the sampling variability, it is very likely that this value is not exactly the true value of  $\mu$ , but we are so far unable quantify how much uncertainty there is in this estimate.

# Statistical Intervals

## Definition

*Statistical intervals* define regions that are likely to contain the true value of an estimated parameter.

More formally, it is generally possible to quantify the level of uncertainty associated with the estimation, thereby allowing the derivation of sound conclusions at predefined levels of certainty.

Three of the most common types of interval are:

- Confidence intervals;
- Tolerance intervals;
- Prediction intervals;

# Bibliography

## Required reading

- 1 J.G. Ramírez, *Statistical Intervals: Confidence, Prediction, Enclosure*:  
[https://www.sas.com/resources/whitepaper/wp\\_4430.pdf](https://www.sas.com/resources/whitepaper/wp_4430.pdf)
- 2 D.C. Montgomery and G.C. Runger, *Applied Statistics and Probability for Engineers*, Chapter 8. 3rd Ed., Wiley 2005.

## Recommended reading

- 1 Simply Statistics (blog) - <http://simplystatistics.org>
- 2 R. Dawkins, *Climbing Mount Improbable*, W.W.Norton&Co.,1997.

# About this material

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