

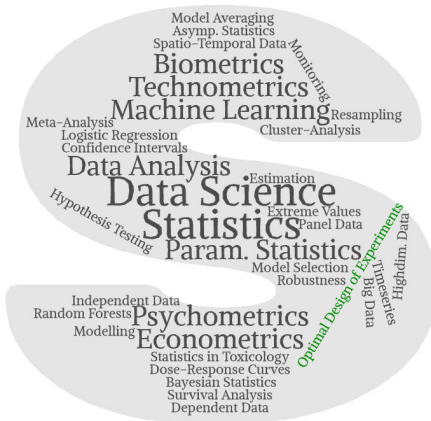
Seminar on Optimal Design of Experiments in Action

Seminarvorstellung

JProf. Dr. Kirsten Schorning

Mathematische Statistik
Statistik
TU Dortmund

Topics and Research Areas in Statistics



Does the Design of Experiments matter?

Simple Linear Regression Model: The relationship between an input x and an output y is modelled by

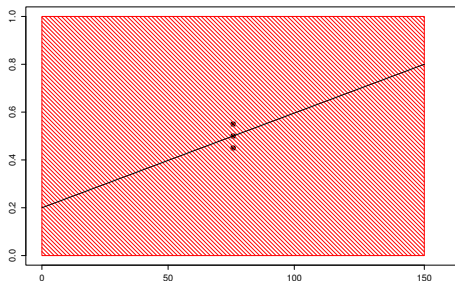
$$Y = ax + b + \varepsilon,$$

where $(a, b)^T \in \mathbb{R}^2$ are unknown.

Question: Which input positions should be selected to get informative observations that result in a precise fit?

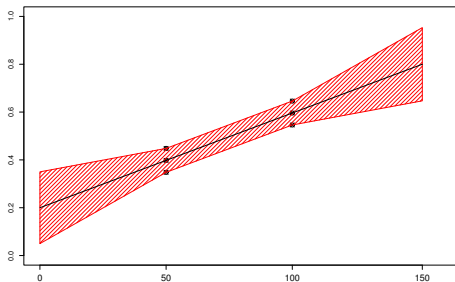
Does the Design of Experiments matter? Example

1. **Idea:** All observations are taken at one point, here at 75.



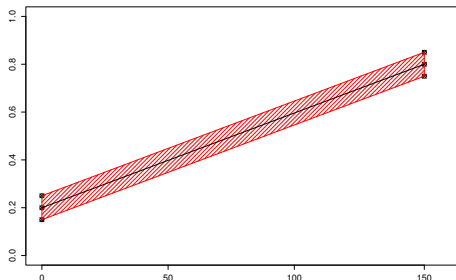
Does the Design of Experiments matter? Example

2. **Idea:** Half of the outputs are measured at 50, half of the outputs are measured at 100.



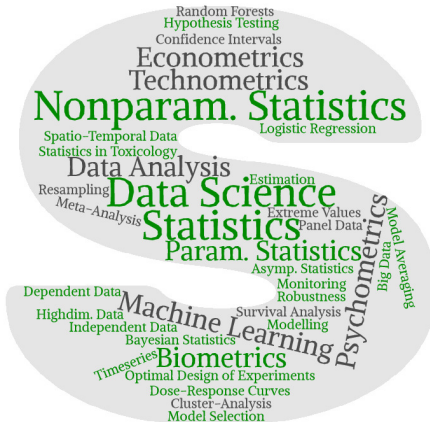
Does the Design of Experiments matter? Example

2. **Idea:** Half of the outputs are measured at 0, half of the outputs are measured at 100.



Design of Experiments matters!

- A careful design even benefits the model fit of such a simple model.
- This also holds true for more complex models in statistics and data science.



Possible topics

- Optimal Design for non linear models:
 - ▶ The MLE in non linear models
 - ▶ locally optimal design and robust design techniques
 - ▶ Application to dose response models
- Optimal Design for spatial data
 - ▶ Exploratory Designs
 - ▶ Designs for Spatial Trend Estimation
 - ▶ Design and Spatial Dependence
- Optimal Design for Computer Experiments
 - ▶ space-filling designs
 - ▶ Latin Hypercube Designs
 - ▶ Criterion-based Experimental Designs

Introductory Reading

To get an overview of the different topics, a quick look at the following books may be helpful:

- Silvey (1980). *Optimal Design. An introduction to the theory for parameter estimation.* Chapman and Hall, London.
- Santner, Williams, Notz (2003). *The Design and Analysis of Computer Experiments.* Springer, New York.
- Müller (2007). *Collecting Spatial Data.* Springer, Berlin.

Time Schedule

Pre-Announcement:

- E-Mail to schorning@statistik.tu-dortmund.de until September, 16th, 2022.

Seminar kick-off meeting:

- First week of the upcoming semester (exact date and time will be announced per E-mail; in agreement with participants)

Meeting to assign seminar topics to participants:

- Third week of the upcoming semester (exact date and time will be announced per E-mail; in agreement with participants)

Seminar presentations:

- Block seminar in January 2023 (exact date and time will be announced per E-mail; in agreement with participants)

Requirements to pass the seminar

Bachelor:

- presentation in English or German with English slides (30 minutes)
- seminar paper either English or German (10 pages)
- active participation in discussions, feedback

Master:

- presentation in English or German with English slides (45 minutes)
- seminar paper either English or German (10 pages)
- active participation in discussions, feedback