

# Design of Experiments in R

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The purpose of Design of Experiments (DoE) is to create an experimental scheme that will generate data “as informative as possible” for the purpose of a planned (series of) experiment(s). Basic ideas in experimental design have been proposed very long ago (Wikipedia mentions references from 18<sup>th</sup> century). Often, R.A.Fisher's contributions in early 20<sup>th</sup> century are seen as the foundation of modern experimentation; he systematically introduced randomization, blocking, replication and factorial design and broadened insights into the applicability of analysis of variance (cf. e.g. the account by his daughter Joan Fisher Box 1980).

Fisher – being based at Rothamsted experimental station in the 1920s and early 1930s – was experienced in agricultural experiments. Agriculture has its own special challenges, e.g. spatial correlation between neighbouring fields. Design of Experiments is also used in many other fields of application, e.g. medicine, psychology, sensometrics or quality improvement. The talk gives an overview of what functionality is available in *R* for experimental design and analysis of experimental data in general (cf. also the Task View on Experimental Design and Analysis of Experimental Data, Grömping 2011) and then focuses on industrial experimentation (cf. e.g. Box, Hunter and Hunter 2005) and a series of *R* packages by the author (**DoE.base**, **FrF2**, **DoE.wrapper**, **RcmdrPlugin.DoE**) as well as other packages (**AlgDesign**, **BsMD**, **DiceDesign**, **lhs**, **rsm**) on which the former rely.

Particularly in connection with offering a GUI, it is also discussed what should be the trade-off between guiding or even forcing untrained useRs to do the right thing vs. offering substantial flexibility and leaving responsibility for appropriate choices with the useR.

## References

Box, G.E.P., Hunter, J.S. and Hunter, W.G. (2005, 2<sup>nd</sup> ed.). *Statistics for Experimenters*. Wiley, New York.

Fisher Box, Joan (1980). R.A.Fisher and the Design of Experiments, 1922-1926. *The American Statistician* **34**, 1-7.

Fisher, R.A. (1935). *The Design of Experiments*. Oliver & Boyd, Edinburgh.

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