TITLE:
The Experimental Unit Information Index: Balancing Evidentiary Value and Sample Size of Adaptive Designs

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ABSTRACT:
Reducing the number of experimental units is one of the three pillars of the 3R principles (Replace, Reduce, Refine) in animal research. At the same time, statistical error rates need to be controlled to enable reliable inferences and decisions. This paper proposes a novel measure to quantify the evidentiary value of one experimental unit for a given study design. The experimental unit information index (EUII) is based on power, Type-I error and sample size, and has attractive interpretations both in terms of frequentist error rates and Bayesian posterior odds. We introduce the EUII in simple statistical test settings and show that its asymptotic value depends only on the assumed relative effect size under the alternative. We then extend the definition to adaptive designs where early stopping for efficacy or futility may cause reductions in sample size. Applications to group-sequential designs and a recently proposed adaptive statistical test procedure show the usefulness of the approach when the goal is to maximize the evidentiary value of one experimental unit.

BRIEF SPEAKER BIO:
Leonhard Held earned his Ph.D. in Statistics at LMU Munich in 1997 under the supervision of Ludwig Fahrmeir. His thesis is on Markov chain Monte Carlo methods to analyze longitudinal data. In 2000- 2006 he was Lecturer, Senior Lecturer and Associate Professor for Biostatistics at Imperial College London, Lancaster University and LMU Munich, respectively. In 2006 he joined the University of Zurich (UZH) as Full Professor. He delivered the Armitage Lecture at the University of Cambridge in 2015 on probabilistic forecasting of infectious disease spread. His current research focuses on the statistical assessment of replicability. He is founding Director of the Center for Reproducible Science and member of the Open Science Workgroup UZH.