Doctoral Program
#OrganizingtheDigital

Relations, Publics, Societies

Course Syllabus

"Linear Mixed Models"

Semester: WS 2021/2022

Course No.:   800984

Lecturer: Daniel Schad

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Teacher

Prof. Dr. phil. Daniel Schad

danieljschad@gmail.com

https://danielschad.github.io/

Course Objectives

The course will provide an introduction to linear mixed-effects models (LMMs) in R. It will start by discussing the linear model. An important topic in LMMs are contrasts, which provide the way to encode hypotheses about factors in linear (mixed effects) models. Therefore, the course will provide a detailed discussion of contrast coding, and will introduce a powerful way to encode any linear hypotheses about factors into contrasts by using the generalised matrix inverse, which can be easily implemented using the R package hypr. The course will also cover the coding of covariates (i.e., continuous predictor variables). Based on the knowledge about contrasts, the second day will provide an introduction to the LMM, it will discuss fixed effects and variance components, and how they can be estimated in R using the lmer function. Moreover, we will treat the important question of how variance components and correlation parameters can be selected to achieve parsimonious LMMs. In case there is interest and enough time, we can moreover discuss power analyses for LMMs using the design R package.

Learning Philosophy and Format – please customize

The course will strongly rely on using the open-source statistical software R to discuss key aspects of data analysis using linear mixed models. The participants are invited to install R as well as R-Studio on their computers before the workshop.

Technical requirements:

The following software equipment will be required:

All sessions
1) Zoom software installed and updated, with functioning microphone and camera. Links to the Sessions will be provided before the start of the course
2) Software R and R-Studio installed and updated

Prerequisites:

Basic knowledge of R / R-Studio, basic understanding of linear models and of frequentist statistics

Course Assignments

Students are requested to perform one full analysis of an existing or simulated data set and to document this using R markdown.

Evaluation

Submitted analyses will be graded as pass or no pass.

Reading Assignments

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*(4), 390-412.

Bates, D. M. (2010). lme4: Mixed-effects modeling with R. https://www.researchgate.net/publication/235709638_Lme4_Mixed-Effects_Modeling_With_R

Schad, D. J., Vasishth, S., Hohenstein, S., & Kliegl, R. (2020). How to capitalize on a priori contrasts in linear (mixed) models: A tutorial. *Journal of Memory and Language*, *110*, 104038.

Additional Literature

Together with Reinhold Kliegl, Audrey Bürki, and Shravan Vasishth, I am currently writing on a text book on linear mixed models; this will become available in the future.

Schedule and Topics

WS2021/2022	Content
5.11.2021 **12:00–13:30**	**Introduction Linear model (LM)** Introducing the course, the method and the task assignment
14:30-16:00	**Session I:** Contrasts, generalised inverse (hypr package) & covariates
16:30-18:00	**Session II:** Contrasts, generalised inverse (hypr package) & covariates
18:30-20:00	**Session III:** Contrasts, generalised inverse (hypr package) & covariates

6.11.2021 **10:00-11:30**	**Introduction Linear mixed model (LMM)**
12:00-13:30	**Session IV** LMM fixed effects & variance components
14:30-16:00	**Session V** LMM selection of variance components / correlation parameters
16:30-18:00	**Session VI** LMM selection of variance components / correlation parameters
18:30-20:00	Final Discussion