Tutorial suggestion for 2016 meetings: Sensometrics and eurosense

Linear mixed effects modeling for multifactorial sensory and consumer data using the r-packages lmer, lmerTest and SensMixed and relations to panelcheck and Consumercheck

Per Bruun Brockhoff& Alexandra Kuznetsova

*Technical University of Denmark*

Abstract:

Sensory and consumer data are produced in massive numbers within as well food research and industry as within many non-food areas, e.g. high end audio and TV production industry. A user friendly open source tool, Panelcheck, for high throughput analyses of sensory quantitative descriptive analysis (QDA) is openly available ([www.panelcheck.com](http://www.panelcheck.com)) including visual tools for simple mixed models for such multi-attribute data. The scope of the mixed modelling in Panelcheck, however, is limited in several ways. In 2014 a new tool, Consumercheck was released (<http://consumercheck.co/>) extending the scope to also include consumer preference data together with background data on as well products as on consumers. Among the available methods in Consumercheck is a user friendly approach for rather general linear mixed modelling of such data avoiding the mixed model limitations that characterizes Panelcheck. The mixed model tools of Consumercheck is based on the newly developed R-packages lmerTest, Kuznetsova, Brockhoff & Christensen (2015) and SensMixed, Kuznetsova, Brockhoff & Christensen (2014) – again based on the lme4-package, Bates et al (2013). In lmerTest, among other things, automated model selection procedures are available to facilitate more easy access to proper mixed modeling for challenging structured situations, Kuznetsova et al (2015). Also recently, the so-called Mixed Assessor Model (MAM) was proposed by Brockhoff, Schlich & Skovgaard (2014) as an improved mixed model analysis of sensory data more properly taking into account the inherent effects of individual differences in perceptive scale use in such data. The MAM approach, however, was introduced in a rather restricted model setting. The combination of the MAM approach with a more general mixed modelling approach covering now most relevant sensory and consumer data situations has been implemented in SensMixed. So has also the recently suggested d-prime like visualizations of the effects in mixed model analysis of sensory and consumer data introduced in Brockhoff et al (2015). The SensMixed package runs either as a usual script-based R-package or optionally as a more user friendly Shiny GUI application.

Plan:

1. Introduction to mixed models by the lmer package,
2. Background on the approaches used in lmerTest, SensMixed and ConsumerCheck
3. Example based tutorials on using lmerTest, SensMixed and ConsumerCheck,
4. Hands-on working with examples or own data

**References**Douglas Bates, Martin Maechler, Ben Bolker and Steven Walker (2013). lme4: Linear mixed-effects models using Eigen and S4. R package version 1.0-4.  
 <http://CRAN.R-project.org/package=lme4>

Brockhoff et al: Online Course Material for DTU course on mixed models:   
<http://www2.imm.dtu.dk/~perbb/st113/Intro/modules.html>

Brockhoff P. B., Amorim I., Kuznetsova A., Søren Bech, Lima R. R. (2015), D-prime interpretation of a standard linear mixed model results (*Revised version submitted to Food Quality and Preference*)

Brockhoff, P. B., Schlich, P., & Skovgaard, I. (2015). Taking individual scaling differences into account by analyzing profile data with the Mixed Assessor Model. *Food Quality and Preference*, *39*, 156-166.

Kuznetsova, A., Christensen, R.H.B., Bavay, C. and Brockhoff, P.B. (2015). Automated mixed ANOVA modeling of sensory and consumer data. *Food Quality and Preference* 40, 31-38

Alexandra Kuznetsova, Per Bruun Brockhoff and Rune Haubo Bojesen Christensen (2015). lmerTest: Tests for random and fixed effects for linear mixed effect models (lmer objects of lme4 package).. R package version 2.0-29. <https://cran.r-project.org/web/packages/lmerTest/>

Alexandra Kuznetsova, Per Bruun Brockhoff and Rune Haubo Bojesen Christensen (2014). SensMixed: Mixed effects modelling for sensory and consumer data. R package version 2.0-8. <http://cran.at.r-project.org/web/packages/SensMixed/>

Panelcheck: [www.panelcheck.com](http://www.panelcheck.com)

Consumercheck: <http://consumercheck.co/>