

Title: Dynamic Longitudinal Modeling

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Abstract:

The goal of this workshop is to introduce participants to dynamic longitudinal modeling with an emphasis on dynamic longitudinal modeling in continuous time. We begin by distinguishing between static and dynamic models for the analysis of change and discuss their respective advantages and disadvantages. Next, we will introduce participants to the basics of continuous time modeling including the R package ctsem. The remainder of the workshop consists of three special topic blocks of unequal length: In Block 1, we will put a special emphasis on heterogeneity, hierarchical models and input effects. In topic Block 2 we will focus on the analysis of time series ( $N = 1$ ) data, oscillations, and accelerated longitudinal designs. In Block 3 we proceed to some cutting-edge research topics on causal inference and machine learning approaches in continuous time modeling including a discussion of the potential and current limitations of these approaches. Although the emphasis will be on applied psychological research, the workshop is targeted to an audience with a primary interest in quantitative methods and with prior experience in multivariate data analysis. Some experience with structural equation models and the analysis of longitudinal data is of advantage but not necessary. Apart from a general introduction to the various modeling procedures, special emphasis will be put on the practical implementation. To this end we will make use of different datasets and different packages in R ([www.r-project.org](http://www.r-project.org)).

Prerequisites:

Participants are requested to bring their own notebooks with a recent version of R and RStudio/Posit installed. Participants who have not been exposed to R before are requested to familiarize themselves with the basic functionality of the program. Advanced knowledge of R is not required for this workshop.

Assignment: Active participation

Credits: 3 workshop days

## Literature:

We do not expect that you prepare any readings in advance. Specific readings will be provided in class. Much of the workshop will be based on the following literature.

- [1] C. C. Driver, J. H. L. Oud, and M. C. Voelkle, "Continuous time structural equation modeling with R package ctsem," *Journal of Statistical Software*, vol. 77, no. 5, pp. 1-35, 2017, doi: 10.18637/jss.v077.i05.
- [2] C. C. Driver and M. C. Voelkle, "Hierarchical Bayesian continuous time dynamic modeling," *Psychological Methods*, vol. 23, no. 4, pp. 774-799, 2018, doi: 10.1037/met0000168.
- [3] Driver, C. C. (2022). Inference With Cross-Lagged Effects—Problems in Time and New Interpretations. OSF Preprints. <https://doi.org/10.31219/osf.io/xd72>
- [4] K. van Montfort, J. H. L. Oud, and M. C. Voelkle, Eds. *Continuous Time Modeling in the Behavioral and Related Sciences*. New York, NY: Springer, 2018.
- [5] M. C. Voelkle, C. Gische, C. C. Driver, and U. Lindenberger, "The role of time in the quest for understanding psychological mechanisms," *Multivariate Behavioral Research*, vol. 53, no. 6, pp. 782-805, 2018/11/02 2018, doi: 10.1080/00273171.2018.1496813.
- [6] M. C. Voelkle, J. H. L. Oud, E. Davidov, and P. Schmidt, "An SEM approach to continuous time modeling of panel data: Relating authoritarianism and anomia," *Psychological Methods*, vol. 17, pp. 176-192, 2012, doi: 10.1037/a0027543.
- [7] M. C. Voelkle and J. H. L. Oud, "Continuous time modelling with individually varying time intervals for oscillating and non-oscillating processes," *British Journal of Mathematical and Statistical Psychology*, pp. 103-126, 2013, doi: 10.1111/j.2044-8317.2012.02043.x.