Title of course:
Dynamic Structural Equation Modeling of Intensive Longitudinal Data Using Mplus Version 8

Abstract:

Mplus Version 8 features new methods for analyzing intensive longitudinal data such as that obtained with ecological momentary assessments, experience sampling methods, daily diary methods, and ambulatory assessments. Typically, such data have a large number of time points, $T = 20-150$. Single-level (N=1) as well as multilevel (N > 1) models with random effects varying across subjects are discussed. The focus is on time series analyses with auto-regressive and moving-average components both for observed-variable models such as regression and cross-lagged analysis and for latent-variable models such as factor analysis, structural equation modeling, IRT, and mixture modeling. Applications to be discussed include:

- multilevel AR(1) model with random mean, random AR, and random variance
- multilevel ARMA(1,1) model
- latent multilevel AR(1) model with multiple indicators
- latent multilevel VAR(1) model and dynamical networks
- dynamic SEM
- dynamic latent class analysis using hidden Markov and Markov-switching AR models

Presenters:
Bengt Muthén (Muthén & Muthén), Tihomir Asparouhov (Muthén & Muthén), and Ellen Hamaker (Utrecht University)

Description:
The Dynamic Structural Equation Modeling (DSEM) framework that is implemented in Mplus Version 8 uses time series models for observed and latent variables to account for the dependencies between observations over time. Such models are applied extensively in engineering and econometrics. In most such applications however multivariate time series data of a single case (i.e., N=1) are analyzed. In contrast, the intensive longitudinal data that are currently gathered in the social sciences typically come from a relatively large sample of individuals, which gives rise to a need for statistical techniques that allow us to analyze the time series data from multiple independent individuals simultaneously; such an approach is based on borrowing information from other cases, while keeping the model flexible enough to allow for subject-specific model parameters. The DSEM framework implemented in Mplus accommodates this more complex modeling need. The DSEM model is a two-level Bayesian extension of the dynamic factor model described in Molenaar (1985), Zhang and Nesselroade (2007) and Zhang et al. (2008). A further development is a time series extension of the existing multilevel mixture framework in Mplus. This makes it possible to analyze hidden Markov models with random transition probabilities and also multilevel regime-switching state-space models.
Course outline:

The workshop will discuss statistical background, applications, and Mplus input specifications. The workshop is scheduled to take place on Monday July 17, 8:30 – 5:30. The day is structured as follows.

- Introduction Part 1: The relationships between auto-regressive modeling, latent growth curve modeling, and multilevel time series modeling
- Introduction Part 2: Time series analysis and state-space modeling
- Statistical background: General model, assumptions, and Bayesian estimation
- Applications with observed variables: Regression and cross-lagged analysis
- Applications with latent variables: Measurement error, Dynamic SEM, IRT
- Applications of change across time: TVEM and intervention analysis
- Applications with latent class variables: Time series LCA and LTA

Presenter bios:

Bengt Muthén obtained his Ph.D. in Statistics at the University of Uppsala, Sweden and is Professor Emeritus at UCLA. He was the 1988-89 President of the Psychometric Society and the 2011 recipient of the Psychometric Society’s Lifetime Achievement Award. He has published extensively on latent variable modeling.

Tihomir Asparouhov obtained his Ph.D. in Mathematics at the California Institute of Technology and has been a part of the Mplus team for 16 years. His research interests are in the area of structural equation modeling, dynamic modeling, complex survey analysis, multilevel modeling, survival analysis, and Bayesian analysis. He has published in journals such as Psychological Methods and Structural Equation Modeling.

Ellen Hamaker obtained her Ph.D. in Psychology at the University of Amsterdam under the supervision of Peter Molenaar, and currently works as associate professor at the Department of Methodology and Statistics, Faculty of Social Sciences, Utrecht University. Her expertise covers time series analysis, state-space modeling, longitudinal multilevel modeling, panel modeling, and structural equation modeling. She has been collaborating with the Mplus team since early 2016 to develop and implement Dynamic Structural Equation Modeling (DSEM) in Mplus 8.