Methods for the study of continuity and change: Modeling quantitative developmental change

Dr. Matthias Reitzle, Thursday, 10 to 12 am, CZ SR 130

Quantitative Change, Growth Curves, and Hierarchical Models

Quantitative change over time is an important – but by far not the exclusive – aspect of life-span developmental research. A restriction to changes in sample means does not really match developmentalists' claim to study interindividual differences in intraindividual development, and their causes. In this vein, a major challenge is to describe and explain differences in the shape and pace of individual change or growth. Why does person A display an accelerated increase, Person B a smooth increase, person C stagnation, and person D even decline? What are the psychological antecedents of these differences, and at which stages of the developmental process do their effects unfold. The most appropriate tools to answer such questions are growth curve models within the general framework of structural equation modeling (e.g., LISREL, AMOS) or, alternatively, within the domain of hierarchical linear modeling (HLM). This course will help students understand the conceptual outline of growth models, and improve their ability to apply these models in a conceptually appropriate and technically correct manner.

Method: The course will start with a comparison of different types of growth curve models in order to establish an understanding for what is the right tool for what particular question. We place emphasis on students' active participation. Therefore, students are not only in charge to present models from the literature, but also to create arguments for and against certain models, and application examples. The second half of this course is more practically oriented. Using laptops and beamers in the classroom, we will analyze data from the Department or students' own research projects, and re-analyze data from the literature. In the latter case, we usually seek the contact to the corresponding authors via email to get their syntax files and outputs, and in front of all, discuss problems and open questions with them. This procedure does not only promote a deeper understanding of the issue in class, but also establishes a working contact between students and authors successfully applying these methods.

Target Group: Advanced MA students and students in a doctoral program. The course will include students from Penn State and the FSU. Language in this course will be English. Participants should be acquainted to structural equation modeling program packages (preferably LISREL or AMOS) and have a basic understanding of the general linear model and matrix algebra.

Grading: At the end of the semester, a written test compiled of multiple choice questions and a few open questions will be taken.

Introductory literature:

Hox, J. (2002). Multilevel analysis. Techniques and applications. Chapter 5: Analyzing longitudinal data (pp. 73-102). Mahwah, NJ: Lawrence Erlbaum.

McArdle, J. J., & Epstein, D. (1987). Latent growth curves within developmental psychology, Child Development, 58, 110-133.

McArdle, J., & Nesselroade, J. R. (2003). Growth curve analysis in contemporary psychological research. In J. A. Schinka & W. F. Velicer (Eds.), Handbook of psychology (Vol. 2, pp. 447-480). Hoboken, NJ: Wiley & Sons.

Semester schedule

Introduction, outline of the semester goals, assignment of active roles to students as presenters, discussants etc.

How growth curves started: The classical work of McArdle & Epstein

McArdle, J. J. & Epstein, D. (1987). Latent growth curves within developmental psychology, Child Development, 58, 110-133.

Learning goals: Understanding the basic ideas, the algebraic and graphic notation of growth curves, and their technical application within the LISREL framework.

(practical exercises)

Learning goals: Ability to set up LISREL command lines to calculate growth curve models, and to interpret the parameters.

Overview over the scope of applications of growth curve models

McArdle, J. & Nesselroade, J. R. (2003). Growth curve analysis in contemporary psychological research. In J. A. Schinka & W. F. Velicer (Eds.), Handbook of Psychology (Vol. 2, pp. 447-480). Hoboken, NJ: Wiley & Sons.

Learning goals: What kind of research questions can be answered with the help of growth curve models. What are their advantages as compared, for example, to repeated measures ANOVAs?

(practical exercises)

Learning goals: How are differential developmental trajectories (interindividual differences in intraindividual change) accounted for in growth curve models: random variation in growth curve parameters versus multi-group models.

Growth curves within the HLM framework (Hierarchical Linear Modeling)

Hox, J. (2002). Multilevel analysis. Techniques and applications. Chapter 5: Analyzing longitudinal data (pp. 73-102). Mahwah, NJ: Lawrence Erlbaum.

Learning goals: How to implement a time structure to growth models, and to test hypotheses about the shape of growth.

(rehearsals and practical exercises)

Learning goals: Understanding the output from HLM growth models and interpret the parameters correctly.

Midterm test

Applications in the literature

Aunola, K., Leskinen, E., Onatsu-Arvilommi, T. & Nurmi, J.-E. (2002). Three methods for studying developmental change: A case of reading skills and self-concept. British Journal of Educational Psychology, 72, 343-364.

Learning goals: Reading, understanding, and repeating growth curve studies correctly.

(practical exercises)

Re-analyzing Anunola's data in the classroom.

Learning goals: Empowerment to ask questions and debate with authors.

Applications in the literature (change predicts change)

Sayer, A. G. & Willett, J. B. (1998). A cross-domain model for growth in adolescent alcohol expectancies. Multivariate Behavioral Research, 33, 509-543.Reddy, R., **Learning goals**: Reading, understanding, and repeating growth curve studies correctly.

(practical exercises)

Re-analyzing Sayer's data in the classroom

Learning goals: Ability to solve model identification problems and technical difficulties.

Answers to all open questions and preparations for the test

<u>Further reading suggestions to get acquainted to growth curve applications</u>

Bertrand, R. M., Willis, S. L., Sayer, A. (2001). An evaluation of change over time in everyday cognitive competence among Alzheimer's patients. *Aging, Neuropsychology, and Cognition*, *8*, 192-212.

Bryant, A. L., Schulenberg, J. E., O'Malley, P. M., Bachman, J. G. & Johnston, L. D. (2003). How academic achievement, attitudes, and behaviors relate to the course of substance use during adolescence: A 6-year, multiwave national longitudinal study. *Journal of Research on Adolescence*, *13*, 361-397.

Finkel, D., Reynolds, C. A., McArdle, J. J., Gatz, M. & Pedersen, N. L. (2003). Latent growth curve analyses of accelerating decline in cognitive abilities in late adulthood. *Developmental Psychology*, *39*, 535-550.

Gutman, L. M., Sameroff, A. J. & Cole, R. (2003). Academic growth curve trajectories from 1st grade to 12th grade: effects of multiple social risk factors and preschool child factors. *Developmental Psychology*, *39*, 777-790.

Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. S. & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development*, *73*, 509-527.

Mackner, L. M., Black, M. M. & Starr, R. H., Jr. (2003). Cognitive development of children in poverty with failure to thrive: A prospective study through age 6. *Journal of Child Psychology and Psychiatry*, *44*, 743-751.

Reddy, R., Rhodes, J. E. & Mulhall, P. (2003). The influence of teacher support on student adjustment in the middle school years: A latent growth curve study. *Development and Psychopathology*, *15*, 119-138.