European University Institute

DEPARTMENT OF POLITICAL AND SOCIAL SCIENCES

Education as a Lifelong Process – Comparing Educational Trajectories in Modern Societies

eduLIFE

ERC Advanced Grant Research Project

Research Design Optimization of Longitudinal Panel Studies

*edu*LIFE Workshop
21 April 2016, Sala del Capitolo, Badia Fiesolana
Organised by Prof Hans-Peter Blossfeld (SPS)
and Prof Ulman Lindenberger (Fernand Braudel Senior Fellow)
Administrative assistant: Adele Battistini
(Adele.Battistini@eui.eu)

Time of Day
Morning session: 9:30-12:00
Afternoon session (optional): 13:30-15:30

The workshop will be divided in two parts. In the morning, we will (i) present power equivalence theory in the context of structural equation modeling, with an emphasis on the identification of individual differences in change; and (ii) provide a demonstration of LIFESPAN, a tool for statistical power estimation developed by the authors. In the afternoon, the instructors will be available for personal consultation. The workshop is of potential interest to predocs, postdocs, and other researchers with an interest in the design and analysis of longitudinal panel studies.

Instructors
Andreas Brandmaier, Max Planck Institute (MPI) for Human Development, Berlin, Germany; Max Planck UCL Centre for Computational Psychiatry and Ageing Research, Berlin/London
Ulman Lindenberger, MPI for Human Development, Berlin, Germany; Max

Planck UCL Centre for Computational Psychiatry and Ageing Research, Berlin/London; Fernand Braudel Fellow 2015-16, European University Institute
Timo von Oertzen, Universität der Bundeswehr München, Munich, Germany; University of Virginia, Charlottesville, USA; MPI for Human Development, Berlin, Germany.

Abstract

The goal of this workshop is to discuss concepts and methods that focus on the statistical power to detect individual differences in change in the context of longitudinal panels. Researchers planning a longitudinal panel typically search, more or less informally, a multivariate study space that includes dimensions such as the hypothesized true variance in change, indicator reliability, the number and spacing of measurement occasions, total study time, and sample size. The main goal of such searches is to select a research design that best addresses the guiding questions and hypotheses of the planned study while heeding to all sorts of external considerations, including time, money, feasibility, and ethical considerations. Hence, longitudinal study selection requires optimization under constraints, and is amenable to the general operating principles of computer-aided design. Based on power equivalence theory (MacCallum et al., 2010; von Oertzen, 2010), we propose a computational framework to augment informal searches by systematic searches in study design space. Starting with an initial design, the proposed framework generates a set of alternative models with equal statistical power for detecting hypothesized effects, and delineates tradeoff relations among relevant parameters, such as total study time and the number of measurement occasions. As an implementation of this framework, we present LIFESPAN, the Longitudinal Interactive Front End Study Planner. LIFESPAN boosts the efficiency, breadth, and precision of the search for optimal longitudinal designs. Its beta/initial version, which is freely available at http://www.brandmaier.de/lifespan, is geared towards the power to detect variance in change as specified in a linear latent growth curve model (LGCM).

About the Instructors

Dr. Andreas Brandmaier received a doctoral degree in computer science at Saarland University in 2012. Since 2011, he leads the project, "Formal Methods in Lifespan Psychology," at the Center for Lifespan Psychology of the MPI for Human Development, Berlin, Germany. In 2015, Andreas Brandmaier won the Heinz-Billing-Award for the Advancement of Computational Science. Dr. Brandmaier develops methods and computational tools to answer methodological challenges of lifespan psychology. His primary research

interests are individual differences in behavioral and neural development, brain-behavior relations across the lifespan, and the adaption of data mining and machine learning approaches to challenges of psychological research.

Prof. Dr. Ulman Lindenberger received a doctoral degree in psychology at Freie Universität Berlin in 1990. He is the director of the Center for Lifespan Psychology at the Max Planck Institute for Human Development, Berlin, Germany, and the co-director of the Max Planck UCL Centre for Computational Psychiatry and Ageing Research. His primary research interests are brain-behavior relations across the lifespan,
multivariate developmental methodology, and formal models of behavioral change.

Prof. Dr. Timo von Oertzen received a doctoral degree in computer science at Saarland University in 2006. During the last 5 years, Timo von Oertzen worked as an assistant professor in the Quantitative Section of the Department of Psychology at the University of Virginia. In January 2016, he has been appointed full professor of psychology at the Universität der Bundeswehr München in Munich. He also is an adjunct scientist at the MPI for Human Development in Berlin, and a visiting associate professor at the University of Virginia. Timo von Oertzen is interested in formal information description and optimization in the social sciences, and a co-developer of two major structural equation modeling programs, Onyx and OpenMx.

Selected Readings

von Oertzen, T., & Brandmaier, A. M. (2013). Optimal study design with identical power: an application of power equivalence to latent growth curve models. *Psychology and Aging, 28,* 414-428.

Brandmaier, A. M., von Oertzen, T., Ghisletta, P., Hertzog, C., & Lindenberger, U. (2015). LIFESPAN: A tool for the computer-aided design of longitudinal studies. *Frontiers in Psychology,* 6:272.

Hertzog, C., Lindenberger, U., Ghisletta, P., & von Oertzen, T. (2006). On the power of multivariate latent growth curve models to detect correlated change. *Psychological Methods, 11,* 244-252.

Hertzog, C., von Oertzen, T., Ghisletta, P., & Lindenberger, U. (2008). Evaluating the power of latent growth curve models to detect individual differences in change. *Structural Equation Modeling, 15,* 541-563.

MacCallum, R., Lee, T., and Browne, M. W. (2010). The issue of isopower in power analysis for tests of structural equation models. *Structural Equation Modeling, 17,* 23-41.

von Oertzen, T. (2010). Power equivalence in structural equation modeling. *British Journal of Mathematical and Statistical Psychology, 63,* 257-272.
von Oertzen, T., Hertzog, C., Lindenberger, U., & Ghisletta, P. (2010). The effect of multiple indicators on the power to detect inter-individual differences in change. *British Journal of Mathematical and Statistical Psychology, 63,* 627-646.