Meeting of the Working Group SEM
16 and 17 March 2017
Ghent, Belgium

Venue

Congress centre: "Het Pand"
Room: Zaal Rector Vermeylen
Onderbergen 1
9000 Gent (Belgium)
http://www.ugent.be/het-pand/en

Directions

- Arrival by train:

  From station Gent St-Pieters, take tram 1 (every 6 minutes) or tram 24 (every 20 minutes). Exit at Korenmarkt. Walk over the bridge (over the river Leie) towards St. Michael's Church. Turn left at St. Michael's church and follow the building until you reach "Het Pand" on your left.

- Arrival by car:

  Drive in the direction of the city center, and follow the parking signage to parking P7 Sint-Michiels (located at 50 meter from "Het Pand"). To get to the venue from the parking, take the exit Onderbergen and you come out in the Wilderoosstraat, opposite Het Pand. An alternative parking is P8 Ramen (about 5 minutes on foot to "Het Pand")

Contact local organizers

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Social program

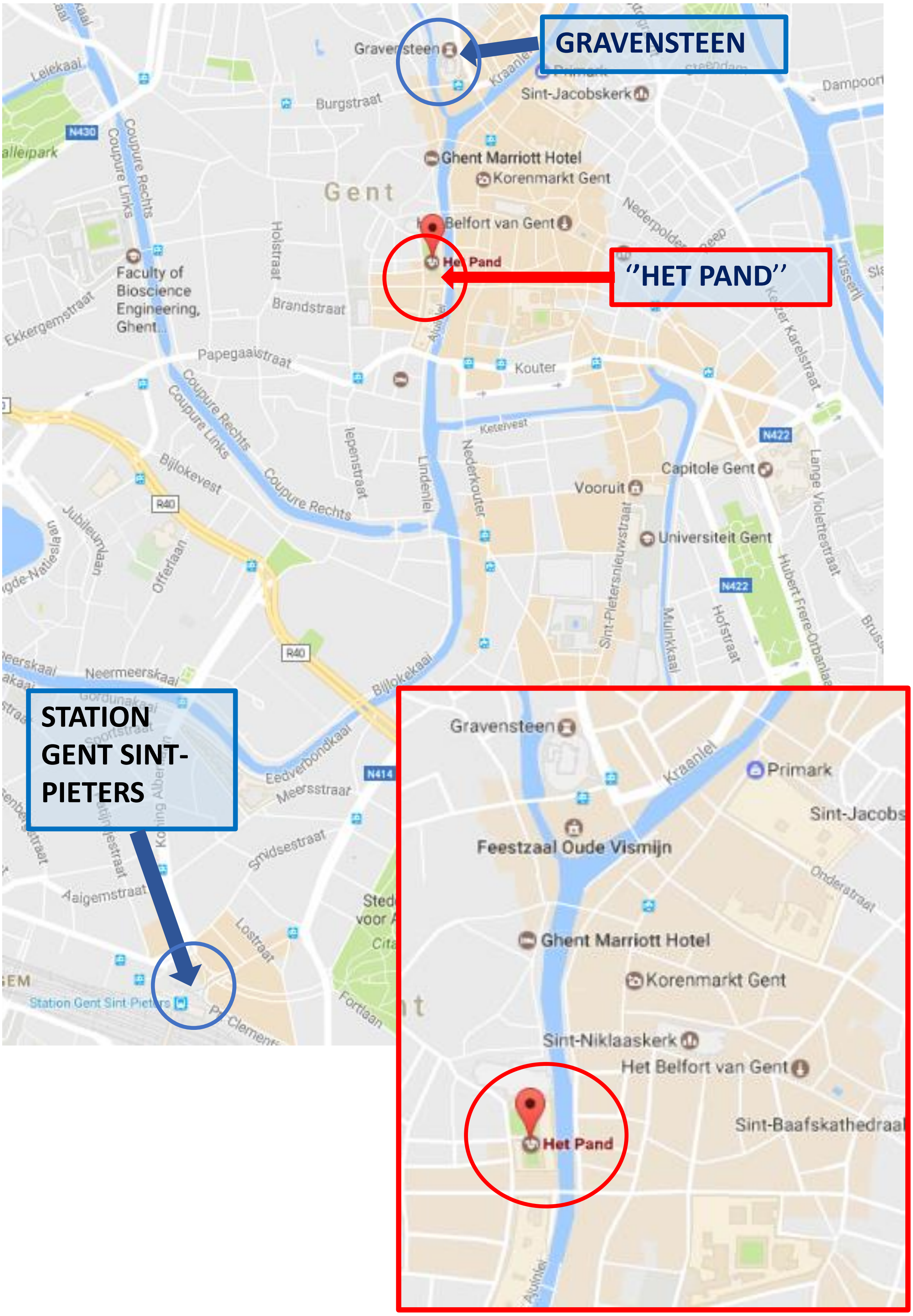
- Conference dinner:
  - Thursday 16 March, 7pm
  - Venue: Brasserie 'Oude Vismijn' (http://brasserieoudevismijn.be/website/)
  - Fixed price: 50 euro (includes 3-course menu, including wine, water, coffee/tea)
  - If you wish to join: please send an email to Yves Rosseel (before March 13th); you will be asked to pay (in cash) when you arrive at the conference
- Drinks and Food:
  - If you stay in Ghent until Saturday
  - Friday 17 March, after the meeting
  - Somewhere in the city center

List of Hotels (near the city center)

Sorted from (very) expensive to less expensive:

- Hotel Harmony
  http://www.hotel-harmony.be/en/
- Ghent Marriott Hotel
  http://www.marriott.com/hotels/travel/gnemc-ghent-marriott-hotel/
- NH Gent Belfort
  http://www.nh-hotels.com/hotel/nh-gent-belfort
- Sandton Grand Hotel Reylof
  http://www.sandton.eu/sandton-grand-hotel-reylof/nl/
- Novotel Gent Centrum
  http://www.novotel.com/gb/hotel-0840-novotel-gent-centrum/index.shtml
- Hotel Best Western Résidence Cour St. Georges
  http://www.courstgeorges.be/
- Ghent River Hotel
  http://www.ghent-river-hotel.be/en/
- Monasterium
  http://monasterium.be
- Hotel Onderbergen
  http://www.hotelonderbergen.be/index.asp?taal=en
- Ibis Gent Centrum St. Baafs Kathedraal
  http://www.accorhotels.com/gb/hotel-0961-ibis-gent-centrum-st-baafs-kathedraal/index.shtml

City plan


GRAVENSTEEN
''HET PAND''
STATION GENT SINT-PIETERS
Gravensteen
Burgstraat
Sint-Jacobskerk
Ghent Marriott Hotel
Korenmarkt Gent
Gent
Belfort van Gent
Het Pand
Faculty of Bioscience Engineering, Ghent...
Brandstraat
Holstraat
Papegaaistraat
Kouter
Coupure Rechts
Coupure Links
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Ketelvest
Lindenlei
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Capitole Gent
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Muinkkaai
Hofstraat
Neermeerskaai
Bijlokekaai
Eedverbondkaai
Meersstraat
Smidsestraat
Aaigemstraat
Lostraat
Station Gent Sint-Pieters
Feestzaal Oude Vismijn
Primark
Kraanlei
Sint-Niklaaskerk
Het Belfort van Gent
Sint-Baafskathedraal
Onderstraat

Timetable Thursday, March 16th

Time	Title & Author(s)
13:30-14:00	Registration
14:00-14:15	*Yves Rosseel & Mariska Barendse* Welcome & Overview
14:15-14:45	*Rens van de Schoot, Marit Sijbrandij, Sonja D. Winter, Sarah Depaoli & Jeroen K. Vermunt* The GRoLTS-Checklist: Guidelines for Reporting on Latent Trajectory Studies
14:45-15:15	*Johannes Textor, Yves Rosseel & Felix Thoemmes* Local Fit Evaluation of Structural Equation Models Using Graphical Criteria
15:15-15:45	*Mathilde Verdam* Evaluating the Difference in Approximate Model Fit: Performance of the ECVI Difference Test
Break	
16:15-16:45	*Steffen Grønneberg & Njål Foldnes* New Testing Procedures for Structural Equation Modeling
16:45-17:15	*Dylan Molenaar* A Hidden Markov Latent Trait - Latent State Structural Equation Model for Bivariate Observations
17:15-17:45	*Harry Garst* Eigenvalues and Eigenvectors in Confirmatory Factor Analysis
17:45-18:15	Meeting of the Working Group
19:00-22:00	Conference dinner 'Oude Vismijn' (registration required)

Timetable Friday, March 17th

Time	Title & Author(s)
09:00-09:30	*Sacha Eskamp* Generalized Network Psychometrics: Combining Network and Latent Variable Models
09:30-10:00	*Pieter M. Kroonenberg* The Use of Deviance Plots for Non-nested Model Selection in Loglinear and Structural Equation Modelling
10:00-10:30	*Herbert Hoijtink & Rens van de Schoot* Testing Small Variance Priors Using Prior-Posterior Predictive P-values
Break	
11:00-11:30	*Axel Mayer* Analyzing Effects with Non-Linear Structural Equation Mixture Modeling in blavaan
11:30-12:00	*Florian Schuberth, Rebecca Büchner, Karin Schermelleh-Engel & Theo K. Dijkstra* Polynomial Factor Models: Non-iterative Estimation via Method-of-moments
12:00-12:30	*Njål Foldnes & Steffen Grønneberg* Covariance Model Simulation using Regular Vines
Lunch	

Timetable Friday, March 17th (continued)

Time	Title & Author(s)
14:00-14:30	*Jörg Betzin* LISREL Estimation in a PLS Data Set
14:30-15:00	*Sara van Erp, Joris Mulder & Daniel L. Oberski* Unifying and Extending Methods for Measurement Invariance using Bayesian Regularization
15:00-15:30	*Terrence D. Jorgensen* Permutation Tests of Configural Invariance: Respecifying Poor-Fitting Measurement Models
Break	
16:00-16:30	*Andrej Srakar & Marilena Vecco* Measuring Deaccessioning in American Museums: A Mimic Approach
16:30-17:00	*Suzanne Jak & Terrence D. Jorgensen* Relating Measurement Invariance, Cross-level Invariance and Multilevel Reliability
Short break	
17:10-17:40	*Christoph Kern & Petra Stein* Effect Comparison in Multilevel Structural Equation Models with Non-Metric Outcomes
17:40-18:10	*Zsuzsa Bakk* A two-step Approach to Latent Class Analysis for Models with Complex Dependencies
18:10-18:15	Closing

Abstracts

The GRoLTS-checklist: Guidelines for Reporting on Latent Trajectory Studies

Rens van de Schoot; University Utrecht, The Netherlands
Marit Sijbrandij; Vrije University Amsterdam, The Netherlands
Sonja D. Winter; University Utrecht, The Netherlands
Sarah Depaoli; University of California, United States
Jeroen K. Vermunt; Tilburg University, The Netherlands

Estimating models within the mixture model framework, like Latent Growth Mixture Modeling (LGMM) or Latent Class Growth Analysis (LCGA), involves making various decisions throughout the estimation process. This has led to a high variety of how results of latent trajectory analysis are reported. To overcome this issue, using a four-round Delphi study, we developed Guidelines for Reporting on Latent Trajectory Studies (GRoLTS). The purpose of GRoLTS is to present criteria that should be included when reporting the results of latent trajectory analysis across research fields. We have gone through a systematic process to identify key components that, according to a panel of experts, are necessary when reporting results for trajectory studies. We applied GRoLTS to 38 papers where LGMM/LCGA was used to study trajectories of post-traumatic stress after a traumatic event.

Local Fit Evaluation of Structural Equation Models Using Graphical Criteria

Johannes Textor; Radboud University, The Netherlands
Yves Rosseel; Ghent University, Belgium
Felix Thoemmes; Cornell University, United States

Testing of model fit is critically important for every structural equation model and sophisticated methods have been developed for this task. Among them are the chi-square goodness-of-fit test, decomposition of the chi-square, derived measures like the popular RMSEA, or CFI, or inspection of residuals or modification indices. Most of these methods provide a global approach to model fit evaluation: A single index is computed that quantifies the fit of the entire SEM to the data. In contrast, by using graphical criteria like d-separation, or trek-separation, one can derive implications that can be used for local fit evaluation, an approach that is hardly ever used. We provide an overview of local fit evaluation from the viewpoint of SEM practitioners. In the presence of significant model misfit, local fit evaluation can potentially help in pinpointing where the problem with the model lies. For models that do fit the data, local tests can identify the parts of the model that are corroborated by the data. Local tests can also be conducted before a model is fitted at all, and they can be used even for models that are globally under-identified. We discuss appropriate statistical local tests, and provide applied examples. We also present novel software in R that automates this type of local fit evaluation.

Evaluating the Difference in Approximate Model Fit: Performance of the ECVI Difference Test

Mathilde Verdam; University of Amsterdam, The Netherlands

In the practice of structural equation modeling researchers often compare different models to the same data in order to test substantive hypotheses. The difference in exact model fit between two hierarchically related models can be tested using the difference in chi-square values. Although this is the most commonly used method for the evaluation of differences

in model fit, it is also generally acknowledged that the chi-square difference tends to become significant in larger samples and favors highly parameterized models. As an alternative, it is possible to evaluate the differences in *approximate* model fit by using the difference in approximate fit indices.
Approximate fit indices are less dependent on sample size and reward model parsimony, but the sampling distributions of many of these approximate fit indices are unknown, and thus they cannot be used for formal hypothesis testing. However, the expected cross validation index (ECVI; Browne & Cudeck, 1989) can be regarded as an exception in this regard. It has a known distribution which allows for the calculation of associated confidence intervals, that can be used to give an indication of the precision of the fit estimates. The difference in ECVI values of two nested models may be used to test the equivalence in approximate model fit (Browne, 1992). However, the ECVI difference test is relatively unknown and stringent evaluation of the performance of the difference between ECVI values for the comparison of nested models has not yet been performed.
The aim of this presentation is to introduce the ECVI difference test and illustrate its potential advantages using an empirical example. In addition, I would like to propose a simulation study to test and compare the performance of the ECVI difference test in various situations against several alternative tests and indices of differences in model fit.

Browne, M.W. (1992) *MUTMUM user's guide.* 2nd edn. Unpublished manuscript, Department of Psychology, The Ohio State University.

Browne, M.W., & Cudeck, R. (1989). Single sample cross-validation indices for covariance structures. *Multivariate Behavioral Research, 24*, 445–455.

New Testing Procedures for Structural Equation Modeling

Steffen Grønneberg; BI Norwegian Business School, Norway
Njål Foldnes; BI Norwegian Business School, Norway

We introduce and evaluate a new class of hypothesis testing procedures for moment structures. The methods are valid under weak assumptions and includes the well-known Satorra-Bentler adjustment as a special case. The proposed procedures applies also to difference testing among nested models. We prove the consistency of our approach. We introduce a bootstrap selection mechanism to optimally choose a p-value approximation for a given sample. Also, we propose bootstrap procedures for assessing the asymptotic robustness (AR) of the normal-theory maximum likelihood test, and for the key assumption underlying the Satorra-Bentler adjustment (Satorra-Bentler consistency). Simulation studies indicate that our new p-value approximations performs well even under severe nonnormality and realistic sample sizes, but that our tests for AR and Satorra-Bentler consistency require very large sample sizes to work well.

A Hidden Markov Latent Trait – Latent State Structural Equation Model for Bivariate Observations

Dylan Molenaar; University of Amsterdam, The Netherlands

It is well acknowledged that in the measurement of psychological constructs, one can distinguish between a relatively stable trait and a more fluctuating 'state' (e.g., Buss, 1989). However, the traditional structural equation models to study the structure of psychological constructs are mainly focused on modeling of the trait. Therefore, the variance in the state of the participants ends up as measurement error in the residual of the model while it may include valuable information about inter- and intraindividual differences in the psychological processes underlying the responses to the measurement instrument. In this talk, it is argued that additional information about the measurement responses (e.g., response times) may improve the separability of trait, state, and measurement error variance. These additional data result in a bivariate vector of observations for each subject- item combination (e.g., a response and a response time). To enable trait – state modeling of such data, a suitable hidden Markov latent trait – latent state structural equation model is presented. The viability of the model in terms of parameter recovery and power is demonstrated in a simulation study, and the model is applied to a real dataset pertaining to logical reasoning.

Eigenvalues and Eigenvectors in Confirmatory Factor Analysis

Harry Garst; University of Amsterdam, The Netherlands

It is widely known that eigenvalues and eigenvectors play a central role in principal components analysis. Perhaps, for some it may be surprising that eigenvalues and eigenvectors also play a role in confirmatory factor analysis. In this talk only the Spearman case (one factor model) will be used to demonstrate its relation with eigenvalues and eigenvectors.

Generalized Network Psychometrics: Combining Network and Latent Variable Models

Sacha Epskamp; University of Amsterdam, The Netherlands

In this presentation, I introduce the network model as a formal psychometric model, conceptualizing the covariance between psychometric indicators as resulting from pairwise interactions between observable variables in a network structure. This contrasts with standard psychometric models, in which the covariance between test items arises from the influence of one or more common latent variables. I present two generalizations of the network model that encompass latent variable structures, establishing network modeling as parts of the more general framework of Structural Equation Modeling (SEM). In the first generalization, the covariance structure of latent variables is modeled as a network. I term this framework Latent Network Modeling (LNM) and show that, with LNM, a unique structure of conditional independence relationships between latent variables can be obtained in an explorative manner. In the second generalization, the residual variance-covariance structure of indicators is modeled as a network. I term this generalization Residual Network Modeling (RNM) and show that, within this framework, identifiable models can be obtained in which local independence is structurally violated. These generalizations allow for a general modeling framework that can be used to fit, and compare, SEM models, network models, and the RNM and LNM generalizations. This methodology has been implemented in the free-to-use software package lvnet, which contains confirmatory model testing as well as two exploratory search algorithms: stepwise search algorithms for low-dimensional datasets and penalized maximum likelihood estimation for larger datasets.

The Use of Deviance Plots for Non-nested Model Selection in Loglinear and Structural Equation Modelling

Pieter M. Kroonenberg; Leiden University and The Three-Mode Company, The Netherlands

Mallows defined the Cp statistic with an associated Cp-plot to be used in model selection in regression analysis. The deviance plot is an generalisation of this idea, where the loss, expressed in Residual Sum of Squares, or the Chi-squared statistic is graphed against the degrees-of-freedom, thus allowing for comparing Deviance/df ratios between models. It is shown that the *RMSEA* (Root Mean Squared Error of Approximation), *AIC* (Akaike's information criterion) and the *BIC* (Bayesian information criterion) are lines in the deviance plot so that these criteria can be used for additional support in model selection.

Testing Small Variance Priors Using Prior-Posterior Predictive P-values

Herbert Hoijtink; University Utrecht, The Netherlands
Rens van de Schoot; University Utrecht, The Netherlands

Muthén and Asparouhov (2012) propose to evaluate model fit in structural equation models based on approximate (using small variance priors) instead of exact equality of (combinations of) parameters to zero. This is an important development that adequately addresses Cohen's (1994) "The earth is round ($p < .05$)", which stresses that point null-hypotheses are so precise that small and irrelevant differences from the null-hypothesis may lead to their rejection. It is tempting to evaluate small variance priors using readily available approaches like the posterior predictive p-value and the DIC. However, as will be shown, both are not suited for the evaluation of models based on small variance priors. In this paper a well behaving alternative, the prior-posterior predictive p-value, will be introduced. It will be shown that it is consistent, the distributions under the null and alternative hypotheses will be elaborated, and it will be applied to testing whether the difference between two means and the size of a correlation are relevantly different from zero.

Cohen, J. (1995). The earth is round ($p < .05$). *American Psychologist, 49*, 997–1003.

Muthén, B., & Asparouhov, T. (2012). Bayesian structural equation modeling: a more flexible representation of substantive theory. *Psychological methods, 17*, 313–335.

Analyzing Effects with Non-Linear Structural Equation Mixture Modeling in blavaan

Axel Mayer; RWTH Aachen University, Germany

We present an approach for an analysis of the effects of interventions based on nonlinear structural equation mixture modeling (NSEMM). We combine the recently proposed EffectLiteR approach for analyzing average and conditional effects and NSEMM to provide applied researchers with modern technology to evaluate the effectiveness of an intervention or a treatment. In the proposed synthesis of the two approaches, we extend the EffectLiteR approach to models with conditional nonlinearities and non-normalities and show how the NSEMM approach can be used to compute various kinds of effects of interest. The approach is illustrated by an example from the educational sciences. We use the R package blavaan to fit the Bayesian NSEMM model and compute the effects of interest based on the fitted model.

Polynomial Factor Models: Non-iterative Estimation via Method-of-moments

Florian Schuberth; University of Würzburg, Germany
Rebecca Büchner; University of Frankfurt, Germany
Karin Schermelleh-Engel; University of Frankfurt, Germany
Theo K. Dijkstra; University of Groningen, The Netherlands

We introduce a non-iterative method-of-moments estimator for non-linear latent variable (LV) models. Under the assumption of joint normality of all exogenous variables, we use the corrected moments of linear combinations of the observed indicators (proxies) to obtain consistent path coefficient and factor loading estimates. However, the estimation also works under milder assumptions. Besides providing the theoretical background, we run a Monte Carlo simulation to compare our approach to the Latent Moderated Structural Equations (LMS), a maximum likelihood estimator which serves as a benchmark. In this context, we use a single equation with two LVs, their quadratic terms and one interaction term. Moreover, we vary the sample size, the number of indicators, the factor loadings, and the correlation between the two exogenous single LVs. The results show that our approach is promising, in particular in situations where the sample size is small and the number of indicators is large. Although we have investigated only a simple model in our study, it is straightforward to extend our approach to deal with an arbitrary number of recursive equations containing an arbitrary number of factors, interaction, and higher-order terms.

Covariance Model Simulation Using Regular Vines

Njål Foldnes; BI Norwegian Business School, Norway
Steffen Grønneberg; BI Norwegian Business School, Norway

We propose a new and flexible simulation method for non-normal data with user-specified marginal distributions, covariance matrix and certain bivariate dependencies. The VITA (VIne To Anything) method is based on regular vines and generalises the NORTA (NORmal To Anything) method. Fundamental theoretical properties of the VITA method are deduced. Two illustrations demonstrate the flexibility and usefulness of VITA in the context of structural equation models.

LISREL Estimation in a PLS Data Set

Jörg Betzin; GKV-Spitzenverband, Germany

There is a recent severe discussion between critics and proponents of partial least squares path modeling (PLS-PM). Essentially initialized by the paper from Rönkkö and Evermann [1]. One of the subjects is the problem, that PLS-PM estimates are often marked as biased and inconsistent. But bias and inconsistency in this circumstance is dened as relatively to the ML-estimators in the so called LISREL model and already Schneeweiß[2] argued, that consistency depends on the data framework we are dealing with. In the presentation we will clarify the theoretical framework for the terms bias and inconsistency and we give a very short overview for the LISREL and PLS-PM models and parameter estimations. Then we introduce a real PLS like data set in the sense of the underlying PLS-PM, where the latent variables are index variables. This kind of data sets will be simulated with given parameters and we show and explain different estimation properties for the LISREL and PLS-PM estimations.

Rönkkö, M., & J. Evermann (2013) A critical examination of common beliefs about partial least squares pathmodeling *Organizational Research Methods, 16*, 425–448.

Schneeweiß, H., (1993). Consistency at large in models with latent variables. *Elsevier*, 299–320.

Unifying and Extending Methods for Measurement Invariance using Bayesian Regularization

Sara van Erp; Tilburg University, The Netherlands
Joris Mulder; Tilburg University, The Netherlands
Daniel L. Oberski; Utrecht University, The Netherlands

When comparing multiple groups it is important to establish measurement invariance (MI), meaning that the latent construct under investigation is measured in the same way across groups. Traditionally, MI is tested using multiple group confirmatory factor analysis (MG-CFA) with certain restrictions on the model. The goal is often to attain scalar invariance, which sets the loadings and intercepts equal across groups, so that factor means can be meaningfully compared. In practice, however, scalar invariance is often an unattainable ideal. Therefore, several alternative methods have been proposed to test for MI, such as partial MI, Bayesian approximate MI, and the alignment method. Although these techniques relax the restrictions imposed by the scalar invariance model, they do impose specific assumptions about the underlying structure of MI. Both the alignment method and approximate MI assume many small deviations from invariance, while partial MI requires at least two invariant items.

In this presentation, the different methods for MI will be unified by considering them as specific regularization approaches. Regularization methods (e.g. lasso, ridge) are popular in sparse regression problems where the number of predictor variables is (much) greater than the number of observations. Traditionally, these approaches minimize a loss function subject to a norm constraint or penalty on some parameters, where different norm constraints lead to different shrinkage behaviors. We will show how the problem of MI resembles the sparse regression problem and how the existing methods for MI relate to regularization approaches. We adopt a Bayesian approach, which provides more flexibility. Bayesian analysis combines the likelihood of the data with a prior distribution to obtain a posterior distribution that is used to make inferences. It has been shown that, under certain prior distributions, the mode of the posterior distribution corresponds to popular regularization approaches. Employing this Bayesian regularization framework therefore allows us to 1) unify the existing methods for MI and 2) extend the current toolbox by considering different priors. Specifically, we will consider prior distributions that are less stringent in their assumptions about the structure of MI, thereby allowing to model additional forms of MI. Several penalties and their corresponding prior distributions will be discussed in relation to MI and their behavior will be investigated through multiple illustrations. Finally, we will provide recommendations on how to choose between the different possible prior distributions.

Permutation Tests of Configural Invariance: Respecifying Poor-Fitting Measurement Models

Terrence D. Jorgensen; University of Amsterdam, The Netherlands

The assumption of measurement equivalence/invariance must be verified before valid comparisons of common-factor variances, correlations, or means can be made between groups. Configural invariance (equivalence of measurement-model configuration across groups) is typically investigated by evaluating overall fit of the same model simultaneously to multiple samples. However, the null hypothesis (H_0) of configural invariance is merely that the model provides as good a description of one population as it does for another population (e.g., men and women or respondents from different countries), regardless of whether the model fits perfectly or approximately. Evaluating overall fit therefore tests the wrong H0 by confounding group equivalence with overall model fit. Because χ^2 tests tend to reject good approximate models (constituting Type I errors when group equivalence truly holds), researchers often rely on approximate fit indices, using rules-of-thumb developed under conditions that may not match their own data. Permutation tests of configural invariance yield nominal Type I error rates even when a model does not fit perfectly. This article extends the omnibus permutation test of configural invariance to test equivalence of fit for each pair of groups, allowing researchers to identify for which groups it would be possible to test metric or scalar invariance. Results have implications for ad hoc model modification, guiding researchers to reconsider the structure of poorly fitting measurement models either separately for each group or simultaneously across all groups. I present Monte Carlo simulation results revealing how well these new methods perform, and I demonstrate their application using the Holzinger and Swineford (1939) data set.

Measuring Deaccessioning in American Museums: A Mimic Approach

Andrej Srakar; University of Ljubljana, Slovenia
Marilena Vecco; Erasmus University Rotterdam, The Netherlands
Miroslav Verbič; University of Ljubljana, Slovenia

he removal of objects from a museum's collection, i.e., *deaccessioning*, is one of the most debated topics in the literature on museum management. Despite deaccessioning has received a quite large coverage in the past years, the issue of its measurement remains a *mystery*. In our article, we use the Structural Equation Modeling technique of MIMIC to model the actual extent of *adverse* deaccessioning (EEoAD). We define *adverse* deaccessioning as deaccessioning not being focused on improving the collection (but, e.g., to the new facilities, financial issues, etc.). In our analysis, we use the database, constructed on the basis of 990 forms of US nonprofit art museums. The database, which includes 283 museums and information on over 40 variables, covers the years 2002-2014. To model deaccessioning, we use previous findings in the literature on the modelling of the effects of excess endowments in nonprofit firms. As variables predicting the EEoAD we use state regulation; stability of revenues; loan status; extent of yearly revenues; and level of public support. As variables being predicted by the EEoAD, we employ compensation of the managers; level of yearly revenues; and ratio of program to total expenses (the variables' selection is still preliminary). As not only have MIMIC models been used extremely seldom so far in cultural economics and management, but also deaccessioning has never been modelled at all empirically, our article represents a significant step ahead in gaining knowledge on this key phenomenon within the economics and management of museums and cultural economics and management in general.

Relating Measurement Invariance, Cross-level Invariance and Multilevel Reliability

Suzanne Jak; University of Amsterdam, The Netherlands
Terrence D. Jorgensen; University of Amsterdam, The Netherlands

Data often have a nested, multilevel structure, for example when data are collected from children in classrooms. These kind of data complicate the evaluation of reliability and measurement invariance, because several properties can be evaluated at both the individual level and the cluster level, as well as across levels. For example, cross-level invariance implies equal factor loadings across levels, which is needed to give latent variables at the two levels a similar interpretation. Reliability at a specific level refers to the ratio of true score variance over total variance at that level. This paper aims to shine light on the relation between reliability, cross-level invariance and strong factorial invariance across clusters in multilevel data. Specifically, we will illustrate how strong factorial invariance across clusters implies cross-level invariance and perfect reliability at the between-level in multilevel factor models.

Effect Comparison in Multilevel Structural Equation Models with Non-Metric Outcomes

Christoph Kern; University of Duisburg-Essen, Germany
Petra Stein; University of Duisburg-Essen, Germany

This study discusses difficulties of effect comparisons in multilevel structural equation models with non-metric outcomes, such as nonlinear dyadic mixed-effects regression. In these models, the fixation of the level-1 error variances induces substantial drawbacks in the context of effect comparisons which align with the well-known problems of standard single- and multilevel nonlinear models. Specifically, the level-1 and level-2 coefficients as well as the level-2 variance components are implicitly rescaled by the amount of unobserved level-1 residual variation and thus may apparently differ across (and within) equations despite of true effect equality. Against this background, the present study discusses a multilevel extension of the method proposed by Sobel and Arminger (1992) with which potential differences in level-1 residual variation can be taken into account through the specification of non-linear parameter constraints. The problems of effect comparisons in multilevel probit SEM's and the proposed correction method are exemplified with a simulation study.

A two-step Approach to Latent Class Analysis for Models with Complex Dependencies

Zsuzsa Bakk; Leiden University, The Netherlands

Latent class analysis is a statistical method widely used by social and behavioral scientists for building typologies and classifications based on a set of observed characteristics. Examples include typologies of individual's attitudes based on survey questions, subtypes of schizophrenia patients derived from recorded mood symptoms, and classifications of consumers inferred from stated or revealed preferences.
Researchers usually relate the classifications to other variables, for example to assess how attitudes vary by education or nationality. This analysis is usually performed using the method of three-step latent class analysis. While this approach works well in most situations, it fails when the way the latent classes are related to the observed responses differs across subgroups. This often happens for example in cross-national surveys, where the survey questions have a different meaning in some countries due to differences in translation. Using the three-step approach it is impossible to identify and account for these types of differences, leading often to meaningless or unfair conclusions.
I propose a novel two-step latent class approach that can easily identify and adequately model subgroup differences, thus avoiding erroneous conclusions. Furthermore the approach is general enough to be applicable in any situation that requires stepwise latent class modelling.