Psychometric Society

The 74th Annual Meeting of the Psychometric Society

UNIVERSITY OF CAMBRIDGE 800 YEARS 1209 - 2009

The Psychometrics Centre

IMPS 2009

Psychometrics and technology-enhanced education research

Keynote address by Ken Koedinger, Human-Computer Interaction Institute, Carnegie Mellon University, USA

Chair: Brian Junker, Thursday 23rd July, 8.30 - 9.30, Palmeston Lecture Theatre, Fisher Building.

Educational technologies are being increasingly used in schools and colleges. As just one example, the intelligent tutoring system component of our Cognitive Tutor Algebra course is used about two days a week by a half million students a year. On-line tutoring technologies provide students with individualized instructional support beyond that provided by teachers and textbooks alone. Well-designed systems can assess students as they work, adapt instruction to their individual needs, and provide stakeholders with detailed reports on students' strengths and weaknesses. Further, these systems provide a powerful research platform for data collection and experimentation to advance theories of learning, assessment, and instruction.

Models and designs for tests with explanatory rules for their item difficulties.

Symposium organised by Wim van der Linden, CTB/McGraw-Hill, Monteray, USA.

Chair: Wim van der Linden, Thursday 23rd July, 9.40 - 11.00, Palmeston Lecture Theatre, Fisher Building.

Johannes Hartig, *Department of Educational Research Methodology, University of Erfurt, Germany,* Claudia Harsch, *Centre for Applied Linguistics, University of Warwick, UK*, Jana Höhler, *Center for Educational Quality and Evaluation, German Institute for International Educational Research*. Explanatory models for item difficulties in reading and listening comprehension.

Cees Glas, *Department of Research Methodology, Measurement, and Data Analysis, University of Twente, The Netherlands*. MML estimation and Lagrange multiplier tests for item-cloning models.

Hanneke Geerlings, *Department of Research Methodology, Measurement and Data Analysis , University of Twente, The Netherlands*, Wim van der Linden. Optimal design of tests with rule-based item generation.

Andreas Frey and Nicki-Nils Seitz, *Leibniz Institute for Science Education (IPN), Kiel, Germany*. Classification of individuals using multidimensional adaptive testing with feedforward.

Do our rulers still rule?

Symposium organised by Denny Borsboom, Department of Psychology, University of Amsterdam, The Netherlands

Chair: Denny Borsboom, Thursday 23rd July, 11.30 - 12.50, Palmeston Lecture Theatre, Fisher Building.

Kees-Jan Kan, Rogier Kievit, Conor Dolan, Han van der Maas, Department *of Psychology, University of Amsterdam, The Netherlands*. On the interpretation of the CHC Gc factor as Crystallized Intelligence.

Rogier Kievit, Jan-Willem Romeijn, Lourens Waldorp, H. Steven Scholte, Denny Borsboom, *Department of Psychology, University of Amsterdam, The Netherlands*. Causality, Structural Equation Modeling and Cognitive Neuroscience: Psychometric Modeling of Reductive Science. ♥

Denny Borsboom, Lourens Waldorp, Angélique Cramer, Han van der Maas, Conor Dolan, *Department of Psychology, University of Amsterdam, The Netherlands*. What if there were no latent variables? Complex systems and psychometric models.

Angélique Cramer, Lourens Waldorp, Han van der Maas, Denny Borsboom, *Department of Psychology, University of Amsterdam, The Netherlands*. Comorbidity: A network perspective.

Measuring Latent Quantities

Emeritus lecture by Roderick P. McDonald, University of Sydney, Australia

Chair: Brian Junker, Thursday 23rd July, 14.00 - 14.45, Palmeston Lecture Theatre, Fisher Building.

The topic of "estimating" latent quantities - factor scores, latent traits, disturbances, multilevel components - is still subject to confusion and authoritative contradiction. The issues are foundational and difficult to resolve. The confusion arises from failure to distinguish between measurement and prediction, and also from failure to define what is measured. By definition a measurement consists of the quantity to be measured and an (additive) error of measurement. In the standard linear measurement model, it follows that measures of a vector of latent variables are given by the conditional inverses of the common factor loading matrix. These include Bartlett's GLS "estimator", which is ML under usual distribution assumptions.

In contrast, Thomson's "estimator" is given by the particular solution of the factor equations, i.e., from the conditional inverse of the full set of common and unique factor loadings. Thomson's solution is a regression predictor, and, under assumptions, an Empirical Bayes predictor. However, it is not a measure and, contrary to modern practice, should not be used as such. A sufficient condition will be given for "pure" measurement of each latent quantity. A definition will be offered for the latent quantities. Parallel conclusions for item response models, disturbances, and multilevel components will be outlined. (253)

Component-Based Structural Equation Modeling

Symposium organised by Heungsun Hwang, *Department of Psychology, McGill University , Montreal, Canada.*

Chair: Heungsun Hwang, Thursday 23rd July, 14.55 - 16.15, Palmeston Lecture Theatre, Fisher Building.

Michel Tenenhaus, *HEC Paris, France.* A Criterion Based PLS Approach to Structural Equation Modelling.

Yoshio Takane, *Department of Psychology, McGill University, Montreal, Canada.* Symbolic Computation in Generalized Structured Component Analysis.

Irene R. R. Lu, Roland D. Thomas, and Ernest Kwan, *Sprott School of Business, Carleton University, Ottawa, Canada.* The Comparison of Component- and Covariance-Based Structural Equation Modeling Approaches: Bias and Confidence Interval Coverage.

Heungsun Hwang, *Department of Psychology, McGill University , Montreal, Canada.* Regularized Generalized Structured Component Analysis.

DISSERTATION PRIZE WINNER

Chair: Klaas Sijtsma, Thursday 23rd July, 16.45 - 17.30, Palmeston Lecture Theatre, Fisher Building

Random effects models for directed graphs with covariates (188B)

Bonne J.H. Zijlstra, *Department of Educational Sciences, University of Amsterdam, The Netherlands.*
(Contributors: Marijtje A.J. van Duijn, Tom A.B. Snijders)

A social network consists of a set of actors and the ties between them. The p2 model is a statistical model for the analysis of binary social network data with explanatory variables. It allows, for instance, to test whether a tie between two actors with a common property is more likely. The p2 model places special demands on the estimating algorithm because individual differences in sending ties (activity) and in receiving ties (popularity) are modeled using random effects. Because actors both send and receive ties, a cross-nested pattern of random effects results. For the p2 model newly developed Markov Chain Monte Carlo (MCMC) algorithms appear to provide estimates with small bias and adequate coverage rates. Utilizing the MCMC estimation, a multilevel p2 model, assuming multiple network observations to be representative of a population of social networks, is proposed. This may for instance be the case when networks in multiple school classes are observed. A multivariate p2 model, for the analysis of multiple networks observed on the same set of actors, is proposed as well. For friendship and advice networks between collegues, for instance.

Some new connections for nonparametric item response modeling

Presidential address by Brian Junker, Department of Statistics, Carnegie Mellon University, Pittsburgh, USA

Chair: Paul de Boeck, Thursday 23rd July, 17.30 - 18.30, Palmeston Lecture Theatre, Fisher Building.

Statistical modeling of assessment (psychological testing) data has been going on since the beginning of the 20th century - almost as long as statistics as a formal discipline has existed. The most successful approach has been through item response theory (IRT) and its variations on parametric mixed effects logit and probit models, in which the random effect represents a generic measure of students' "proficiency" (essentially, a finer-grained version of number-right scores). In parallel, several "nonparametric" approaches focused on a general class of mixture-of-product-Bernoulli (and related) models, of which the parametric IRT models were the best known subclass. The primary goals of nonparametric IRT were to determine if desirable "measurement" features held, and if so, to develop model-free or model-light methods of inference about students (hopefully at some computational savings). Current challenges in assessment modeling revolve around replacing the continuous ``proficiency'' random effect with a vector of discrete ``skill indicators'', converting the IRT model into a restricted latent class model. A nonparamteric approach to these so-called cognitive diagnosis models (CDM's) is also developing, with many of the same goals as nonparameteric IRT. In this talk I will highlight some of the history of nonparametric IRT and preview some new approaches in non-parametric and model-light CDM methods.

Palmeston Lecture Theatre

Psychometrics Society 2009

Business Meeting 18.00 -18.30

- *Banquet is at 20.00 in St John's Dining Hall*

Identification Problems in Psychometrics

Symposium organised by Ernesto San Martín, Department of Statistics & Measurement Center MIDE UC, Pontificia Universidad Católica de Chile.

Chair: Ernesto San Martín, Friday 24th July, 9.30 - 10.50, Palmeston Lecture Theatre, Fisher Building.

Javier Revuelta, *Department of Social Psychology and Methodology, Universidad Autónoma de Madrid, Spain*. Identifiability for GLLIRM models that are more general than the NCM.

Alejandro Jara, *Department of Statistics, Universidad de Concepción, Chile*, and Ernesto San Martín, *Department of Statistics & Measurement Center MIDE-UC, Pontificia Universidad Católica de Chile, Chile*. Bayesian Semiparametric IRT-type Models.

Timo Bechger, and Gunter Maris, *CITO, Dutch National Institute for Educational Measurement, The Netherlands*. Equivalent Diagnostic Classification Models.

Ernesto San Martín, Jean-Marie Rolin *Department of Statistics & Measurement Center MIDE-UC, Pontificia Universidad Católica de Chile, Chile*, and Paul De Boeck. *Institut de Statistique, Université catholique de Louvain, Beligum, Faculty of Psychiology, K. U. Leuven, Belgium*. Identification of Multiple Classification Latent Class Models (MCLCM).