

Advanced Quantitative Methods
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Li Cai, PhD

Ignoramus, in hoc signo laboremus

Academic Appointments

- 7/2008– **Assistant Professor**, *Advanced Quantitative Methods*.
Graduate School of Education and Information Studies, UCLA
- 7/2009– **Assistant Professor (Joint Appointment)**, *Quantitative Psychology*.
Department of Psychology, UCLA

Education

- 2001 **B.A.**, *Business Communication*, Nanjing University.
(With High Distinction)
International Finance Minor
- 2003 **M.A.**, *Journalism and Communication*, The Ohio State University.
Thesis: *Assessing co-termination in the unitizing phase of content analysis: A multi-response randomized blocks permutation approach*
- 2006 **M.S.**, *Mathematical Statistics*, University of North Carolina.
Thesis: *Full-information item factor analysis by Markov chain Monte Carlo stochastic approximation*
- 2008 **Ph.D.**, *Quantitative Psychology*, University of North Carolina.
Dissertation: *A Metropolis-Hastings Robbins-Monro algorithm for maximum likelihood non-linear latent structure analysis with a comprehensive measurement model*

Publications: Statistics & Quantitative Methodology

MacCallum, R. C., Browne, M. W., & **Cai, L.** (2006). Testing differences between nested covariance structure models: Power analysis and null hypotheses. *Psychological Methods*, *11*, 19–35.

Cai, L. (2006). Multi-response permutation procedure as an alternative to the analysis of variance: An SPSS implementation. *Behavior Research Methods*, *38*, 51–59.

Hayes, A. F., & **Cai, L.** (2007). Further evaluating the validity of the conditional decision rule for comparing two independent means. *British Journal of Mathematical and Statistical Psychology*, *60*, 217–244.

Cai, L., & Hayes, A. F. (2008). A new test of linear hypotheses in OLS regression under heteroscedasticity of unknown form. *Journal of Educational and Behavioral Statistics*, *33*, 21–40.

Hayes, A. F., & **Cai, L.** (2008). Using heteroscedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation. *Behavior Research Methods*, *39*, 709–722.

Cai, L. (2008). SEM of another flavour: Two new applications of the supplemented EM algorithm. *British Journal of Mathematical and Statistical Psychology*, *61*, 309–329.

Bauer, D. J., & **Cai, L.** (2009). Consequences of unmodeled nonlinear effects in multilevel models. *Journal of Educational and Behavioral Statistics*, *34*, 97–114.

Cai, L., & Lee, T. (2009). Covariance structure model fit testing under missing data: An application of the supplemented EM algorithm. *Multivariate Behavioral Research*, *44*, 281–304.

Cai, L. (in press). Review of Borkar's (2008) *Stochastic Approximation: A Dynamical Systems Viewpoint*. *Journal of Educational and Behavioral Statistics*.

Publications: Educational and Psychological Measurement

Cai, L., Maydeu-Olivares, A., Coffman, D. L., & Thissen, D. (2006). Limited-information goodness-of-fit testing of item response theory models for sparse 2^p tables. *British Journal of Mathematical and Statistical Psychology*, *59*, 173–194.

Maydeu-Olivares, A., & **Cai, L.** (2006). A cautionary note on using $G^2(\text{dif})$ to assess relative model fit in categorical data analysis. *Multivariate Behavioral Research*, *41*, 55–64.

Curran, P. J., Hussong, A. M., **Cai, L.**, Huang, W., Chassin, L., Sher, K. J., & Zucker, R. A. (2008). Pooling data from multiple prospective studies: The role of item response theory in integrative analysis. *Developmental Psychology*, *44*, 365–380.

Cai, L. (in press). High-dimensional exploratory item factor analysis by a Metropolis-Hastings Robbins-Monro algorithm. *Psychometrika*.

Cai, L. (in press). Metropolis-Hastings Robbins-Monro algorithm for confirmatory item factor analysis. *Journal of Educational and Behavioral Statistics*.

Publications: Substantive Topics

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., DuRant, R., & **Cai, L.** (2006). The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence*, *16*, 159–186.

David, P., Lu, T., Kline, S., & **Cai, L.** (2007). Social effects of an anthropomorphic help agent: The fairness of man and machine. *Cyber Psychology and Behavior*, *10*, 471–474.

Ennett, S. T., Faris, R., Hipp, J., Foshee, V. A., Bauman, K. E., Hussong, A. M., & **Cai, L.** (2008). Peer smoking, other peer attributes, and adolescent cigarette smoking: A social network analysis. *Prevention Science*, *9*, 88–98.

Hussong, A. M., **Cai, L.**, Curran, P. J., Flora, D. B., Chassin, L. A., & Zucker, R. A. (2008). Disaggregating the distal, proximal, and time-varying effects of parent alcoholism on children's internalizing symptoms. *Journal of Abnormal Child Psychology*, *36*, 335–346.

Ennett, S. T., Foshee, V. A., Bauman, K. E., Hussong, A. M., Faris, R., Hipp, J., **Cai, L.**, et al. (2008). The social ecology of adolescent alcohol misuse. *Child Development*, *79*, 1777-1791.

Book Chapters

Preacher, K. J., **Cai, L.**, & MacCallum, R. C. (2007). Alternatives to traditional model comparison strategies for covariance structure models. In T. D. Little, J. A. Bovaird, & N. A. Card (Eds.), *Modeling contextual effects in longitudinal studies* (pp. 33–62). Mahwah, NJ: Lawrence Erlbaum Associates.

MacCallum, R. C., Browne, M. W., & **Cai, L.** (2007). Factor analysis models as approximations: some history and some implications. In R. Cudeck & R. C. MacCallum (Eds.), *Factor analysis at 100: Historical developments and future directions* (pp. 153–175). Mahwah, NJ: Lawrence Erlbaum Associates.

Thissen, D., **Cai, L.**, & Bock, R. D. (in press). The nominal categories item response model. In M. L. Nering & R. Ostini (Eds.), *Handbook of polytomous item response theory models: Development and applications*. New York, NY: Taylor & Francis.

Computer Software

Cai, L., du Toit, S. H. C., & Thissen, D. (forthcoming). *IRTPRO: Flexible, multidimensional, multiple categorical IRT modeling*. Chicago, IL: Scientific Software International.

Awards and Honors

- 1998, 1999 **University Scholarship**, *Nanjing University*.
- 1999 **Best Non-Native English Speaker**, *The English-Speaking Union*, International English Public Speaking Competition, London, Britain..
- 1999 **First Prize**, *China Daily*, National College English Public Speaking Competition.
- 1999 **University President's Special Scholarship**, *Nanjing University*.
- 2000 **Guang-Hua Scholarship**, *Nanjing University*.
- 2003 **Elected to Kappa Tau Alpha**, National Honor Society of Journalism & Mass Communication.
- 2003 **Research Award**, *Kappa Tau Alpha*, National Honor Society of Journalism & Mass Communication.
- 2003 **Chaffee-McLeod Award**, *Association for Education in Journalism & Mass Communication*, Communication Theory & Methodology Division.
Best student paper in the open paper competition
- 2006 **Lyle V. Jones Award**, *L. L. Thurstone Psychometric Laboratory*.
Annual award to one graduate student for outstanding scholarship and citizenship in the Thurstone Psychometric Laboratory at UNC-Chapel Hill

- 2007-2008 **Gulliksen Psychometric Research Fellowship**, *Educational Testing Service*.
A competitive nine-month dissertation fellowship awarded by the ETS
- 2008 **Dean's Distinguished Dissertation Award**, *University of North Carolina*.
For best dissertation research in social, behavioral, and economic sciences
- 2009 **AERA Outstanding Quantitative Dissertation Award**, *American Educational Research Association*.
For best dissertation in educational measurement and methodology
- 2009 **NCME Brenda H. Loyd Outstanding Dissertation Award**, *National Council on Measurement in Education*.
The award honors an outstanding dissertation in educational measurement.

Extramural Grant Support

- 2007-2008 **Dissertation Improvement Award**, *National Science Foundation*.
Title: *A Metropolis-Hastings Robbins-Monro Algorithm for Maximum Likelihood Confirmatory Item Factor Analysis*
Role: Co-PI (Robert C. MacCallum, PI, UNC-Chapel Hill)
- 2008-2013 **Pre-doctoral Training Grant**, *Institute of Education Sciences*.
Title: *Doctoral Training Program in Advanced Quantitative Methods in Education Research*
Role: Core Faculty (Noreen Webb, PI, UCLA)
- 2009-2014 **R01**, *National Institute on Drug Abuse*.
Title: *Development and Evaluation of a Smoking Module for PROMIS*
Role: Investigator (Maria Orlando Edelen, PI, RAND)

Invited Conference Sessions

- November 2006 **Cai, L.** A Markov chain Monte Carlo stochastic approximation algorithm for item factor analysis. *Invited Session, Advances in Adaptive Quadrature Meeting, Center for Health Statistics, University of Illinois at Chicago, Chicago, IL.*
- November 2006 **Cai, L.** A Metropolis-Hastings Robbins-Monro algorithm for item factor analysis. *Quantitative psychology colloquium, Department of Psychology, The Ohio State University, Columbus, OH.*
- June 2007 **Cai, L.** A Metropolis-Hastings Robbins-Monro algorithm for maximum likelihood nonlinear latent structure analysis. *Invited Seminar, Research & Development Division, Educational Testing Service, Princeton, NJ.*
- September 2007 **Cai, L.** A Metropolis-Hastings Robbins-Monro algorithm for maximum likelihood nonlinear latent structure analysis. *Quantitative psychology colloquium, Department of Psychology, University of Notre Dame, Notre Dame, IN.*
- May 2008 **Cai, L.** A Metropolis-Hastings Robbins-Monro algorithm for maximum likelihood nonlinear latent structure analysis. *Invited Talk, Annual Convention of the Association for Psychological Science, Chicago, IL.*
- June 2008 **Cai, L.** Full information confirmatory item factor analysis with a Metropolis-Hastings Robbins-Monro algorithm. *Invited Session, The Second Patient Reported Outcomes Measurement Information System (PROMIS) Psychometric Summit, Evanston, IL.*

- July 2008 **Cai, L.** Stochastic approximation for maximum likelihood parameter estimation in nonlinear latent variable models. *Invited Symposium Contribution, 2008 International Meeting of the Psychometric Society, Durham, NH.*
- May 2009 **Cai, L.** Modern psychological measurement: New developments in item response theory. *Chair of Invited Symposium, Annual Convention of the Association for Psychological Science, San Francisco, CA.*
- May 2009 **Cai, L.** Flexible multidimensional, multiple categorical IRT modeling. *Invited Symposium Contribution, Annual Convention of the Association for Psychological Science, San Francisco, CA.*
- July 2009 **Cai, L.** Multidimensional IRT in longitudinal assessment of Patient Reported Outcomes. *Invited Session, Statistical and Applied Mathematical Sciences Institute, Summer Psychometric Program, Durham, NC.*

Conference Presentations

- November 2002 Eveland, W. P., Eastin, M., Marton, K., Liu, K., & **Cai, L.** Non-response bias, context dependency, social desirability, and response set: An experimental comparison of web vs. telephone surveys. *Paper presented at the 2002 meeting of the Midwest Association for Public Opinion Research, Chicago, IL.*
- October 2002 David, P., Lu, T., & **Cai, L.** Computers as social actors: Testing the fairness of man and machine. *Paper presented at the Fifth Annual International Workshop, Presence 2002, Universidade Fernando Pessoa, Porto, Portugal.*
- May 2003 **Cai, L.**, David, P., Lu, T., Liu, K., Cortese, J., & Seo, M. Testing the boundaries of the Media Equation in a computer game situation: When an evaluation by a human means more than an evaluation by a computer. *Paper presented at the 2003 meeting of the International Communication Association, San Diego, CA.*
- August 2003 **Cai, L.** Assessing co-termination between coders in unitizing textual data: A Multi-response Randomized Blocks Permutation approach. *Paper presented at the 2003 meeting of the Association for Education in Journalism & Mass Communication, Kansas City, MO. (Top Student Paper).*
- May 2004 Eveland, W. P., Seo, M., Cortese, J., **Cai, L.**, Wang, Z., Thomson, T., Seitman, R., & Sipos, I. News use, discussion, and knowledge of local public affairs: An experimental and observational study. *Paper presented at the 2004 meeting of the International Communication Association, New Orleans, LA.*
- June 2004 MacCallum, R. C., Browne, M. W., & **Cai, L.** Testing differences between structural equation models: Power analyses and null hypotheses. *Paper presented at the 2004 International Meeting of the Psychometric Society, Monterey, CA.*
- October 2004 **Cai, L.** Limited information goodness-of-fit testing for latent variable models fitted to sparse 2^P tables. *Paper presented at the 2004 Society of Multivariate Experimental Psychology graduate student pre-conference, Naples, FL.*

- April 2005 Pungello, E. P., Campbell, F. A., Burchinal, M. R., **Cai, L.**, Wasik, B. H., & Ramey, C. T. Early risk and educational intervention predicting to young adult outcomes within a high-risk population. *Paper presented at the 2005 biennial meeting of the Society for Research in Child Development, Atlanta, GA.*
- March 2006 Ennett, S. T., Foshee, V. A., Bauman, K. E., Hussong, A., Faris, R., Hipp, J., & **Cai, L.** The social context of adolescent substance use. *Paper presented at the 2006 biennial meeting of the Society for Research on Adolescence, San Francisco, CA.*
- June 2006 Thissen, D., **Cai, L.**, & Bock, R. D. A new parameterization of the nominal item response model. *Paper presented at the International Meeting of the Psychometric Society, Montréal, Canada.*
- June 2006 **Cai, L.** SEM of another flavor: Two new applications of the supplemented EM algorithm. *Paper presented at the 2006 International Meeting of the Psychometric Society, Montréal, Canada.*
- October 2006 **Cai, L.** Full-information item factor analysis by Markov chain Monte Carlo stochastic approximation. *Paper presented at the 2006 Society of Multivariate Experimental Psychology graduate student pre-conference, Lawrence, KS.*
- February 2007 Curran, P. J., Hussong, A. M., **Cai, L.**, & Huang, W. The integrative analysis of three data sets: Internalizing symptomatology from ages 10 to 33. *Paper presented at the 2007 meeting of the Conference on Emerging Adulthood, Tucson, AZ.*
- July 2008 **Cai, L.**, & Thissen, D. Implementation of a Supplemented EM algorithm to compute the error covariance matrix for ML parameter estimates in item response theory models. *Paper presented at the 2008 International Meeting of the Psychometric Society, Durham, NH.*

Extramural Consulting

- 2007–2009 **SBIR Award, National Cancer Institute.**
Title: *MedPRO: An IRT-based outcomes research system*
Role: Consultant (Stephen H. C. du Toit, PI)
Innovative research award to Scientific Software International for the development of a next-generation item response theory modeling software
- 2007–2009 **SBIR Award, National Institute on Alcohol Abuse and Alcoholism.**
Title: *Longitudinal analysis of complex survey data with LISREL*
Role: Consultant (Stephen H. C. du Toit, PI)
Innovative research award to Scientific Software International for the development of new features in the LISREL program for structural equation modeling
- 2009-2010 **SBIR Award, National Institute of Mental Health.**
Title: *A Flexible, Web-based System for Design, Support, and Delivery of Adaptive Tests*
Role: Consultant (Robert Wirth, PI)

Service and Affiliations

- (co)advising Ji Seung Yang
Jon Schweig
Jennifer Wright

- committees Denise Tsai (Statistics)
Leslie Seay (Education)
Monica Lin (Education)
- service Coordinator for the quantitative colloquium series at UNC-Chapel Hill (2005 - 2006)
President of the quantitative student organization (2006 - 2007)
Organizer for the 2007 SMEP graduate pre-conference
Faculty advisory committee for UCLA ATS statistical consulting group
- reviewer The American Statistician
Applied Psychological Measurement
Behavior Research Methods
British Journal of Mathematical and Statistical Psychology
Communication Methods and Measures
Human Communication Research
Journal of Educational and Behavioral Statistics
Methodology: European J. of Res. Methods in Behavioral and Social Sciences
Multivariate Behavioral Research
Psychometrika
Psychological Methods
AERA (Division D)
NCME
- affiliations American Educational Research Association
Association for Psychological Science
National Council on Measurement in Education
Psychometric Society