DEVELOPMENTAL METHODS 2018 CONFERENCE

www.developmentalmethods.org

September 27-29, 2018

Grouse Mountain Lodge
Whitefish, MT
# Table of Contents

**Conference Highlights** ................................................................. 1

**Schedule-at-a-Glance** ................................................................. 2

**Detailed Schedule** ....................................................................... 3 - 12

  - **Day 1: Thursday, September 27** ............................................. 3 - 6
  - **Day 2: Friday, September 28** .................................................. 7 - 10
  - **Day 3: Saturday, September 29** ............................................ 11 - 12

**Abstracts** .................................................................................. 13 - 48

**Workshops** ................................................................................ 13 - 14

**Papers** ....................................................................................... 15 - 34

**Posters** ..................................................................................... 35 - 48
CONFERENCE HIGHLIGHTS

Keynote speakers: **Dr. Kathryn Lemery-Chalfant** and **Dr. David MacKinnon**

Free workshops by:

- **Dr. Jonathan Helm** on Bayesian estimation in Mplus.
- **Dr. Nilam Ram** on nonlinear growth modeling.
- **Dr. Niall Bolger** on intensive longitudinal methods.
- **Dr. Karen Nylund-Gibson** on latent transition analysis in Mplus.

Conference registration and check-in available 8-9:00am each morning in the Continental Divide Foyer.

Light breakfast snacks available beginning at 8am through morning break and all-day coffee in the Continental Divide Foyer for all conference participants.

Buffet lunch from 12:15-1:15pm each day in the Glacier Room for all conference participants.

Poster sessions with cash bar and complimentary hors d’oeuvres from 5:15-6:45pm on Thursday and Friday in the Glacier Room.

Open Developmental Methods Forum on Saturday from 1:15-3:30pm in the Continental Divide Room.

Conference Organizers: Katherine Masyn, Kevin Grimm, and Marcus Waldman

Sponsored by **Yhat Enterprises, LLC.** (Todd Little, Principal Owner)

This conference was made possible by a generous donation from the **Society of Multivariate Experimental Psychology (SMEP).**
<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
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<th>Room 1</th>
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CD = Continental Divide
Day 1: Thursday, September 27

**Detailed Schedule**

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<th>Coffee and Registration</th>
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**Keynote 1:**

**Developmental Science Through a Genetically-Informed Lens**

Kathryn Lemery-Chalfant, Ph.D.
Professor of Psychology
Arizona State University

Based on contemporary developmental theories that stipulate transactional processes across levels of analysis (e.g., Bronfenbrenner’s Bioecological Model), my team redesigns behavior genetic models to include the appropriate covariates, mediation (gene-environment correlation), and moderation (gene-environment interaction) when predicting developmental processes and outcomes. From quantitative genetic designs such as twin and adoption studies, we know that about half of the variance in psychological traits and disorders is accounted for by heritable differences among individuals. Stability is largely heritable, and surprisingly, heritability increases with age. From molecular genetic designs such as candidate gene studies and genome-wide association studies, we know that main effects of any one genetic polymorphism are very small and cannot reliably be identified without extremely large samples (i.e., sample sizes in the tens or hundreds of thousands). By moving beyond simplistic main effects models, we fit genetically-informed developmental models. These models explain why, for example, heritability of executive functioning is higher under higher family adversity. In addition, they illustrate that the latest polygenic risk score for children’s aggression predicts children’s aggression, but this association is mediated by lower toddler behavioral inhibition and can be mitigated by a parenting-based psychosocial intervention. By utilizing genetically-informed designs based on theory, we advance understanding of both genetic and environmental underpinnings of development.

**Break**

| 10:15-10:30am | CD Foyer |
Concurrent Paper Session 1.1

**Paper Session 1.1A**

**Paper Session 1.1A**

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<tr>
<th>Paper</th>
<th>Author(s)</th>
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<tbody>
<tr>
<td>Model Fit and Comparison of the Latent Change Score Model in Small Samples</td>
<td>Sarfaraz Serang</td>
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**Paper Session 1.1B**

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<tr>
<th>Paper</th>
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<tbody>
<tr>
<td>A Multi-Level Structural Equation Model Investigating Parenting, Youth Decision-Making, and Dyadic Physiological Synchrony</td>
<td>Sihong Liu, Assaf Oshri, Margaret O. Caughy, Erinn B. Duprey, &amp; Emilie P. Smith</td>
</tr>
<tr>
<td>Adult Day Services (ADS) Use Benefits Dementia Caregivers Daily Affect: Testing the Within-, and Between-person Mediations</td>
<td>Yin Liu, Lauren R. Bangerter, Kyungmin Kim, &amp; Steven H. Zarit</td>
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**Lunch**

12:15-1:15pm  Glacier Room

**Workshop 1:**

1:15-5:00pm  Alpine/Nordic

An Introduction to Bayesian Estimation with Mplus
Jonathan Helm, Ph.D.
Assistant Professor of Quantitative Psychology
San Diego State University
<table>
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<tr>
<td><strong>Paper</strong></td>
<td><strong>Author(s)</strong></td>
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<tr>
<td>The Utility of Accelerated Longitudinal Designs for Capturing Age-related Development</td>
<td>Nicholas J. Jackson</td>
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<tr>
<td>Centered-ANCOVA: A Solution for Lord’s Paradox with Implications for Valid Causal Inferences in Longitudinal Analyses</td>
<td>Hua Lin &amp; Robert E. Larzelere</td>
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<td>The Discover and Fix Method for Analyzing the Longitudinal Experiment: Controlling QRPs and Incorporating Pre-registration</td>
<td>John Protzko</td>
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<td><strong>Paper</strong></td>
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<tr>
<td>Dynamic Measurement Invariance using Dynamical Systems Approaches: The Measurement Model of Derivatives</td>
<td>Ryne Estabrook</td>
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<tr>
<td>Accounting for Standard Errors of Measurement in Change Modeling</td>
<td>Kevin J. Grimm, Kimberly Fine, &amp; Gabriela Stegmann</td>
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<tr>
<td>More Efficient Estimation of Derivatives for Visualizing Dynamical Systems</td>
<td>Pascal R. Deboeck</td>
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<td><strong>Poster</strong></td>
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<tr>
<td>Waves of Change: How Many Waves of Assessment are needed to Effectively Disaggregate Autoregressive and Growth Curve Processes?</td>
<td>D. Angus Clark, Amy K. Nuttall, &amp; Ryan P. Bowles</td>
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<tr>
<td>Sensitivity Analysis for Mediation Effect in Longitudinal Designs</td>
<td>Qinyun Lin, Amy K. Nuttall, &amp; Kenneth A. Frank</td>
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<tr>
<td>Marital Conflict and Its Microlevel Processes: Applications of the Experience Sampling Method</td>
<td>Mengyu Gao &amp; E. Mark Cummings</td>
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<tr>
<td>Does Empathy Have a Cost? Older Adults’ Encounters with Social Partners Incurring Problems and Mood throughout the Day</td>
<td>Meng Huo, Jamie L. Graham, &amp; Karen L. Fingerman</td>
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<td>Variable-centered and Person-centered Approaches for Psychometric Investigation of Measurement Invariance</td>
<td>Hyanghee Lee</td>
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<tr>
<td>Applying a Mixture Modeling Approach to Parentification Theory: Family Profiles and Child Adjustment Trajectories</td>
<td>Amy K. Nuttall, Kristin Valentino, E. Mark Cummings, &amp; Patrick T. Davies</td>
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<td>Latent Profile Analysis of Risk Groups of Special Education Teacher Attrition</td>
<td>Soyoung Park</td>
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<tr>
<td>Comparison of Newly Introduced Weight Trajectories to Structural Equation Modeling to Explore Children’s Weight Longitudinally</td>
<td>Julie M. Rutledge, Taren Swindle, Amanda W. Harrist, Laura Hubbs-Tait, Glade L. Topham, Robert E. Larzelere, &amp; Lenka H. Shriver</td>
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<td>Differential Covariate Association between Construct Operationalizations</td>
<td>Yusuke Shono, Alan W. Stacy, &amp; Brian P. Flaherty</td>
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<tr>
<td>Optimizing the Power of Positive Relationships: Which Preschool Teachers Benefit Most from Professional Development Coaching?</td>
<td>Crystal Lederhos Smith, Gitanjali Shrestha, Eleanor Dizon, Ben Bayly, Senait Tekle, &amp; Brittany Rhoades Cooper</td>
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<td>How Best to Assess the Dynamic System of Preparation for Bias Socialization as a Moderator?</td>
<td>Kimberly Osborne &amp; Margaret Caughy</td>
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<tr>
<td>How Do We Handle Multi-wave Varying Measures of Physical Activity with Uneven Time Intervals between Waves?</td>
<td>Julia C. Tang</td>
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Day 2: Friday, September 28

**Coffee and Registration**  
8:00-9:00am  
Continental Divide Foyer

**Keynote 2:**  
9:00-10:15am  
Continental Divide

**Modern Methods for Studying Mediating Mechanisms**  
David MacKinnon, Ph.D.  
Foundation Professor of Psychology  
Arizona State University

This presentation describes modern developments in mediation analysis for simple and complex mediation models. Improvements from the causal inference literature include a focus on estimating causal effects rather than associations, the investigation of confounders and colliders as well as mediators, development of estimators based on the potential outcomes framework, and methods to assess the sensitivity of estimates to violations of model assumptions. In some cases, these improvements lead to the same coefficients as traditional methods but in many cases, they do not. Improvements from the general methodology literature are techniques for estimating nonlinear as well as linear change, application of methods based on prediction as well as explanation, and attention to measurement issues in mediation analysis. The promise of these new methods is that they will enhance our ability to explain the process or mechanism by which one variable affects another. Such information informs theory and provides the basis for successful intervention.

**Break**  
10:15-10:30am  
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**Concurrent Paper Session 2.1**

10:30am-12:15pm

**Paper Session 2.1A**

**Paper Session 2.1A**

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<tr>
<td>Continuous and Discrete Time: Different Inferences from the Same Multi-Wave Data</td>
<td>Pascal R. Deboeck</td>
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<td>Using Response Times from High-stakes and Formative Test to Estimate Abilities and to Compare Groups</td>
<td>Daniel B. Wright</td>
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<tr>
<td>Using Machine Learning to Identify Time-Invariant and Time-Varying Covariates Predictive of Longitudinal Outcomes</td>
<td>Gabriela M. Stegmann &amp; Kevin J. Grimm</td>
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**Paper Session 2.1B**

**Paper Session 2.1B**

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<tr>
<td>Model Comparison and Selection for Mediation with Zero-Inflated Count Outcomes</td>
<td>Holly P. O'Rourke</td>
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<tr>
<td>Preventing Child Maladjustment by Improving Parents’ Emotion Socialization: A Randomized Controlled Trial of a Military Parenting Intervention</td>
<td>Na Zhang, SunKyung Lee, Jingchen Zhang, Timothy Piehler, &amp; Abigail Gewirtz</td>
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<td>Less is More: Emotion Regulation Deficits in Military Fathers Magnify their Benefit from a Parenting Program</td>
<td>Jingchen Zhang, Na Zhang, Abigail Gewirtz, &amp; Timothy Piehler</td>
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**Lunch**

12:15-1:15pm

Glacier Room

**Workshop 2:**

**Workshop 2:**

1:15-5:00pm

Alpine/Nordic

**Growth Modeling: Pushing into Nonlinearity**

Nilam Ram, Ph.D.
Professor of Human Development and Family Studies
Penn State University
### Paper Session 2.2

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<tr>
<td>Combining Data Sets through Integrative Data Analysis: The What, Why, and How</td>
<td>Sara K. Johnson &amp; M. B. Weiner</td>
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<tr>
<td>Lag as Moderator Meta-Analysis (LAMMA): A Methodological Approach for Synthesizing Longitudinal Data</td>
<td>Noel A. Card</td>
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<td>A Comparison of Bayesian Synthesis Approaches for Comparing Two Group Means</td>
<td>Han Du, Thomas N. Bradbury, Justin A. Lavner, Andrea L. Meltzer, James K. McNulty, Lisa A. Neff, &amp; Benjamin R. Karney</td>
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### Break

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### Paper Symposium 2.3

**Heterogeneity in Longitudinal Changes with Different Turning Points: A Comparison with Traditional Approaches** (Chair: Kandauda A. S. Wickrama)

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<tr>
<td>A Growth Mixture Model of Depressive Symptoms</td>
<td>Catherine W. O'Neal</td>
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<td>A Piecewise Linear-Linear Growth Mixture Model of Depressive Symptoms with a Known Knot Approach</td>
<td>Kandauda A. S. Wickrama</td>
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<tr>
<td>A Piecewise Linear-Linear Growth Mixture Model of Depressive Symptoms with an Unknown Knot Approach</td>
<td>Tae Kyoung Lee &amp; Kandauda A. S. Wickrama</td>
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<tr>
<td>Exploring Mediation from a Person-Oriented Perspective</td>
<td>Heather L. Smyth &amp; David P. MacKinnon</td>
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<td>Dynamic Structural Equation Models (DSEM) for Lifestyle Factors Associated with Cognitive Performance</td>
<td>Kathleen S. Caffrey, Jonathan Preszler, G. Leonard Burns, Bruce R. Wright, &amp; Maureen Schmitter-Edgecombe</td>
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<td>Measuring Discrimination: Construct Validation of an Abbreviated Version of the Everyday Discrimination Scale</td>
<td>Shanting Chen &amp; Aprile Benner</td>
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<td>Relationship Commitment: Variability and Continuity in Married Couples</td>
<td>Hyanghee Lee</td>
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<td>Use of Latent Profile Analysis to Examine Discrepancies in Multi-Method Parenting Measures</td>
<td>Sun-Kyung Lee, Kadie Aushebauer, Timothy Piehler, Abigail Gewirtz, &amp; Gerald August</td>
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<td>Skill Profile Analysis of Struggling Readers with Non-Adequate Growth: Analysis of Two National Datasets</td>
<td>B. Jasmine Park, Xiaying Zheng, Mengyi Li, Yuan Zhang, &amp; Thomas Sun</td>
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<td>Implementation of a 3-Form Planned Missing Data Design in the Context of Repeated Measures and Multiple Informants</td>
<td>Charlie Rioux, Natalie Castellanos-Ryan, Jean R. Séguiun, &amp; Sophie Parent</td>
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<td>Comparison of Data Collection Methods and Analytic Approaches to Intervention Fidelity Monitoring</td>
<td>Taren M. Swindle, Julie M. Rutledge, James Selig, Leanne Whiteside-Mansell, &amp; Geoff Curran</td>
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<td>What are the Best Methods for Examining Self-beliefs of Aging and Psychological Change in Rural Community-dwelling Older Adults?</td>
<td>Anna C. McCarrey</td>
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<td>How Should Authors Move from Multilevel Linear Growth Curve Analyses to More Complex Models and Report the Results?</td>
<td>Danielle Riser, Henry May, &amp; Rena Hallam</td>
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<td>Parent-Child Acculturation Status and Adolescent Language Brokering Experiences in Mexican Immigrant Families</td>
<td>Minyu Zhang, Su Yeong Kim, &amp; Yang Hou</td>
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Day 3: Saturday, September 29

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**Workshop 3.1:**

***Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research***

Niall Bolger, Ph.D.
Professor of Psychology
Columbia University

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<tr>
<td>Measurement Invariance in Latent Transition Analysis</td>
<td>Katherine E. Masyn</td>
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<tr>
<td>A Latent Transition Analysis of College Student Suicide Risk Trajectories Predicted by Depression and Anxiety Symptomatology</td>
<td>Nicholas J. Parr &amp; John R. Seeley</td>
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**Paper Session 3.2**

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<td>Modern Methods for the Treatment of Missing Data in Longitudinal Research</td>
<td>Todd Little</td>
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<td>Bias Correction for Replacement Samples in Longitudinal Research</td>
<td>Jessica A. M. Mazen &amp; Xin Tong</td>
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<td>Advancing Multiple Imputation for Latent Profile Analysis</td>
<td>Marcus R. Waldman</td>
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<td>Glacier Room</td>
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<td><strong>Workshop 3.2:</strong></td>
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<td>Alpine/Nordic</td>
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<td>Introduction to Latent Transition Analysis in Mplus</td>
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<td>Karen Nylund-Gibson, Ph.D.</td>
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**Workshop Abstracts**

**Workshop 1**
Thursday, September 27, 1:15-5:00pm, Alpine/Nordic

*An Introduction to Bayesian Estimation with Mplus*

*Jonathan Helm, Ph.D.*
Assistant Professor of Quantitative Psychology
San Diego State University

Applications of Bayesian estimation within psychological science have grown exponentially throughout the past two decades. These come as a contrast to frequentist (i.e., maximum likelihood) estimation, which remains dominant in the field. Although many psychological scientists are aware of these two separate approaches, far fewer understand their differences. This workshop introduces attendees to the philosophical, conceptual, and technical* differences that underlie frequentist and Bayesian estimation. In particular, attendees will see how the different philosophies lead to different estimation approaches, and how the different estimation approaches can behave differently. Three empirical examples will illustrate the similarities and differences between the approaches, which will all be conducted via Mplus (example scripts and data sets will be made available). By the workshops end, attendees will be able to characterize the conceptual differences between Bayesian and frequentist estimation, and independently perform Bayesian estimation using Mplus.

*The technical part will be very light! You will understand everything!*

**Workshop 2**
Friday, September 28, 1:15-5:00pm, Alpine/Nordic

*Growth Modeling: Pushing into Nonlinearity*

*Nilam Ram, Ph.D.*
Professor of Human Development and Family Studies
Penn State University

This workshop discusses nonlinear growth models from the multilevel and structural equation modeling perspectives. Growth models have become a mainstay of longitudinal data analysis in the social and behavioral sciences to examine how individuals change over time and how individuals differ in their change process. This advanced workshop will cover the following topics: overview of the definition of nonlinearity with respect to growth models, growth models that are nonlinear with respect to time, parameters, and random coefficients. Code examples provided in R.
Workshop 3.1
Saturday, September 29, 8:30am-12:15pm, Alpine/Nordic

Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research

Niall Bolger, Ph.D.
Professor of Psychology
Columbia University

Intensive longitudinal methods, often called experience sampling, daily diary, or ecological momentary assessment methods, allow researchers to study people’s thoughts, emotions, and behaviors in their natural contexts. Typically, they involve self-reports from individuals, dyads, families or other small groups over the course of hours, days, and weeks. Such data can reveal life as it is actually lived and provide insights that are not possible using conventional experimental or survey research methods. Intensive longitudinal data, however, present data analytic challenges stemming from the multiple levels of analysis and temporal dependencies in the data. In this half-day workshop, participants will (a) recognize the types of research questions that can be addressed using intensive longitudinal methods; (b) see example datasets and how to run basic longitudinal models using SPSS Mixed and Mplus; and (c) understand in broad strokes how complex topics such as dyadic, mediation, and power analyses can be handled using Mplus. We will assume that participants are familiar with multiple regression analysis and ANOVA.


Data sets and syntax for analyses can be found here: www.intensivelongitudinal.com

Workshop 3.2
Saturday, September 29, 1:15-5:00pm, Alpine/Nordic

Introduction to Latent Transition Analysis

Karen Nylund-Gibson, Ph.D.
Associate Professor of Quantitative Research Methods
University of California, Santa Barbara

This half day course will introduce participants to latent transition analysis (LTA) and its specification in Mplus. We will highlight how the LTA model addresses longitudinal change and how it is different than growth models. The implementation and interpretation of the LTA model be demonstrated throughout the course. Some familiarity with latent class and latent profile models in Mplus would be desirable, but not required.
Autoregressive, Cross-lagged, and Time-varying Predictor Effects in Models of Growth and Change

Joseph A. Olsen

A number of models have recently been proposed or advocated for modifying or combining regressive and trajectory-based modeling of longitudinal data reflecting growth and change processes, including:

- Random intercept cross-lagged panel models (RI-CLPM; Hamaker, Kuiper, & Grasman, 2015),
- Random effects cross-lagged panel models (RE-CLPM; Wu, Carrol, & Chen, 2017),
- Fixed effects dynamic panel models (FI-DPM; Allison, Williams, & Moral-Benito, 2017),
- Latent variable-autoregressive latent trajectory models (LV-ALT; Bianconcini & Bollen, 2018), and

The paper shows how to specify and estimate these and other related models, including latent change score (LCS) models and the original observed variable autoregressive latent trajectory (ALT) model. We compare and evaluate the models in terms of 1) separation of the within-person and between-person aspects of the analysis, 2) the analytic treatment of the mean structure of the data, and 3) whether the autoregressive, cross-lagged, and time-varying dynamics are applied to a) the observed variables, b) the residuals, or c) the estimated true scores. For example, the RI-CLPM and the LGC-SR focus on distinguishing within-person from between-person effects, the LV-ALT and the LGC-SR generally have a non-saturated mean structure, and the original ALT and FI-DPM model regressive effects among the observed variables.

The models are applied to real and simulated population data on two related time-varying observed variables. Some models treat such data symmetrically as two parallel or intertwining processes, while others inherently treat one of the variables as dependent or conditional upon the other. The exposition is initially limited to single-population time-structured continuous data with individuals measured at the same relatively small number (t = 4 to 10) of equally-spaced occasions. Missing data is generally accommodated and handled through direct FIML methods when models are implemented with structural equation modeling. Certain of the models are also readily estimated as multilevel models or as hybrid multilevel structural equation models. The models are depicted visually in the form of path diagrams and we provide associated syntax for Mplus and Stata sem or gsem.

We also explore general or conditional equivalence of certain of the models. For example, Usami, Hayes & McArdle (2015) identified conditions under which the LCS is equivalent to the CLPM or the LGM. Such equivalences and alternate parameterizations allow potentially interesting transitive model comparisons, even among models from different model families. Finally, we offer illustrative examples of research questions that can be suitably addressed by the various models, much as Muniz-Terrera et al. (2017) have done more specifically with respect to LGC models. The models differ in their goals and capabilities and in their strengths and weaknesses, depending on the underlying data-generating processes. They significantly broaden the range of possibilities for modeling dynamics and trajectories in developmental studies, and we encourage researchers to consider them where they are consistent with theoretical expectations and research goals.
Model Fit and Comparison of the Latent Change Score Model in Small Samples

Sarfaraz Serang

As with most models fit in the SEM framework, the latent change score model (LCSM; McArdle, 2001) is typically fit to large samples (N > 100). This is in part because measures of model fit (e.g., model chi-square) require large samples to achieve asymptotic behavior. Recent work on the latent growth curve model (LGM; Meredith & Tisak, 1990) has shown that small sample corrections (SSCs) can be used to adjust the model chi-square so that it follows its stated reference distribution even in samples as small as N = 20 (McNeish & Harring, 2017).

McNeish and Harring (2017) found that Bartlett’s correction (Bartlett, 1950) and Yuan’s correction (Yuan, 2005) were the most effective SSCs. However, both are a function of the number of latent variables in the model. Because of their dynamic nature, LCSMs include far more latent variables in their model specification, which limits the usefulness of these SSCs in LCSMs since they overcorrect the model chi-square.

One solution is to use the Monte Carlo test (Bartlett, 1963) which was recently adapted for SEM (Jalal & Bentler, in press). The Monte Carlo test simulates samples under the null hypothesis, fits the model of interest to calculate model chi-squares for each of these samples, then determines the critical value from this distribution of test statistics. Jalal and Bentler (in press) demonstrated that the Monte Carlo test worked well for CFA models under a broad range of conditions.

The current work extends the Monte Carlo test to allow for model comparison via the likelihood ratio test and to accommodate missing data. It demonstrates how both the model chi-square and SSCs are inadequate for LCSMs in small samples with missing data. It also shows that SSCs do not perform well when used to compare nested models. The proposed extension of the Monte Carlo test is shown to perform excellently both with regard to model fit and model comparison. The method is then applied to real empirical data to demonstrate its use in practice.


Julia Yan & Sarah J. Schoppe-Sullivan

Romantic relationships are prevalent during adolescence and engagement in romantic relationships may affect socio-emotional development (Collins, Welsh, & Furman, 2009). For instance, Beckmeyer (2015) found that participation in serious romantic relationships was associated with increased odds of substance use, including alcohol, tobacco, and marijuana. The current study takes a step further to distinguish causation from selection effect of serious romantic relationship participation on adolescents’ socio-emotional development, by computing each adolescent’s probability to participate in romantic relationships (i.e., propensity scores) and adjusting the model using the scores (i.e., Inverse Probability to Treatment Weighting; IPTW). IPTW balances the baseline covariates among treatments, therefore reducing the non-randomness in treatment assignment (i.e., adolescents engage in romantic relationships or not), and creates an experiment-like condition to allow for causal inference (Austin & Stuart, 2015).

Estimating propensity scores is more of a prediction problem than an explanatory problem. However, most studies estimate propensity scores with logistic regression (Westreich, Lessler, & Funk, 2011). Very limited attention has been paid to evaluating model assumptions and cross-validation errors. Westreich et al. (2011) suggested considering machine learning methods, and in particular, using boosting algorithms as an alternative to logistic regression. Boosting methods are robust against overfitting issues and perform well in classification problems (Schapire, 2003).

Using information about adolescent’s family background, physical development, and socio-emotional development in middle childhood in NICHD Study of Early Child Care and Youth Development (SECCYD), the boosting model correctly predicted whether the adolescent participated in serious romantic relationships in 75% of the cases with test data, with
both specificity and sensitivity greater than 70%. Applying the inverse probability weighting with resulting propensity scores, we found that adolescents who participated in serious relationships were less work-oriented and more likely to take risks. However, these adolescents were also less lonely and perceived themselves to be more popular.

**Paper Session 1.1B**
Thursday, September 27, 10:30am-12:15pm, Alpine/Nordic

**A Multi-Level Structural Equation Model Investigating Parenting, Youth Decision-Making, and Dyadic Physiological Synchrony**

*Sihong Liu, Assaf Oshri, Margaret O. Caughy, Erinn B. Duprey, & Emilie P. Smith*

Introduction: Parent-child dyad interactions have been demonstrated to play an important role in child development. Specifically, researchers are interested in how parent-child physiological synchrony (i.e. the matching of biological states between dyads) influence youth’s behavioral outcomes (Feldman, 2012). However, approaches used to model physiological synchrony have significant methodological pitfalls. These methods neglect to account for the existing dependency of within- and between-subject measurement over-time and in relation to the dyadic relationship. Thus, we propose to integrate structural equation modeling and multi-level analyses to use multi-level structural equation model (MSEM) to more effectively address these methodological pitfalls inherent to research on physiological synchrony. Specifically, we proposed an MSEM model in which we examined the moderating role of parent-child respiratory sinus arrhythmia (RSA; a physiological indicator of self-regulation) in the associations between parenting behaviors and children’s decision-making.

The current study used a sample of 101 parent-child dyads with children aged 9-12 years old (Mage=10.28, 52% female, 78% African American). Video-recorded parent-child interactions during a 10-minute conflict task were rated using 7 parenting items: positivity, engagement, respect, reasoning, coercion, intrusiveness, and negativity. Negative indicators were reversely coded so that higher scores indicated better parenting behaviors. Then, a confirmatory factor analysis was used to create a latent factor of observed parenting behaviors, in which reasoning was trimmed due to low loading coefficient (λ<.30). During the conflict task, parents’ and youth’s RSA data were obtained using the Mindware ECG signals, respectively, which were further parsed into 30-second epochs and first-differentiated (i.e. RSA of each time-point was subtracted from the next one to remove the linear trends that may impact correlations). Youth’s decision-making was assessed through the Balloon Analogue Risk Task (BART).

MSEM in Mplus7.4 was used to test the moderating role of RSA synchrony on the associations between parenting and children’s risky decision-making. In the first level (i.e. within-dyad RSA), the MSEM model was applied to 30-second epochs of first-differentiated RSA data using the equation below, in which cRSAi,t and pRSAi,t denoted the ith children and parent’s RSA values at time t. The effect of the ith parent RSA on children’s RSA was used as the RSA synchrony index (denoted as Syci)

\[
cRSAi,t = Inc0 + Syci*pRSAi,t + \epsilon_i,t
\]
In the second level (i.e. between dyads), a structural equation model was constructed to test the moderating role of RSA synchrony (Syci) on the effect of parenting latent factor (Parentingi) on children’s BART performance (BARTi), following the equations below:

\[ \text{BARTi} = \beta_0 + \beta_1 \text{Parentingi} + \beta_2 \text{Syci} + \beta_3 \text{Parentingi} \ast \text{Syci} + \mu_1 \]

Results & Conclusions: The first level analysis exhibited non-significant intercept and residual variances. In the second level, observed parenting (B=-52.46, SE=22.53, p<.05), RSA synchrony (B=-234.74, SE=57.33, p<.001), and the interaction term between parenting and RSA synchrony (B=-122.89, SE=36.54, p<.01) were all associated with youth’s less risky decision-making. Johnson-Neyman plot was used to probe the moderating effect of RSA synchrony, and results indicated that higher RSA synchrony magnified the effects of good parenting behaviors on reducing youth’s risky decision-making. The current study provided a new analytic approach—MSEM—to model dyadic physiological synchrony and answer more complicated research questions.

**Adult Day Services (ADS) Use Benefits Dementia Caregivers Daily Affect: Testing the Within-, and Between-person Mediations**

*Yin Liu, Lauren R. Bangerter, Kyungmin Kim, & Steven H. Zarit*

Distress associated with the behavior and psychological symptoms of dementia (BPSD) has long been considered a major part of the negative impact of dementia caregiving. This study examined how daily adult day services (ADS) use may improve daily mood by reducing daily BPSD distress among 173 dementia family caregivers. Over 8 consecutive days, caregivers used ADS on some of the days, and provided active care on the others. The BPSD distress and mood were measured once daily. Multilevel structural equation models were fit to examine the within-person (i.e., an ADS day) and between-person (i.e., total ADS days) mediations of BPSD distress. An ADS day was indirectly associated with lower daily negative affect and higher positive affect through lower BPSD distress. There was not any between-person mediation based on total ADS days. This study is among the first to explore the causal mechanism on how ADS use may benefit daily mood.

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**Paper Session 1.2**

**Thursday, September 27, 1:15-3:00pm, Continental Divide**

**The Utility of Accelerated Longitudinal Designs for Capturing Age-related Development**

*Nicholas J. Jackson*

Longitudinal designs are the gold standard for researchers studying within-subject changes in age-related development. These designs are typically conducted using a single cohort followed for a fixed period of time. However, single-cohort designs often necessitate a lengthy time commitment from participants, sponsors, and researchers which make them vulnerable to greater attrition and even premature termination. The time commitment for these designs also means that the results may be obsolete by the time they are published, particularly if the outcomes under study are sensitive to generational differences. Bell (1953) proposed the use of an Accelerated Longitudinal Design (ALD) as a means to generate age-based trajectories over a shortened duration to combat these issues. In the ALD multiple birth-cohorts are studied simultaneously in a longitudinal fashion with overlap in the age distributions between the cohorts. In this manner the same age span may be studied while reducing the number of measurements per participant, the overall study duration, and study costs. These designs also allow for the modeling of between-cohort differences, which are important
for researchers interested in developing age-based trajectories that generalize to multiple cohorts. While models that incorporate cultural or generational influence seem increasingly relevant in this time of rapid generational change, there has not yet been widespread adoption of these designs. Part of the hesitancy to use ALDs stems from their unfamiliarity, as few methodological papers have demonstrated the efficacy of these designs for studying development. In this paper we review the current state of methodological research on ALDs and present simulations to address the utility of ALDs in small samples. We first propose a reconceptualization of the ALD cost equations from Galbraith, Bowden, and Mander (2014) which utilize the substantial cost-savings of the ALD to determine sample sizes that are of equal cost to a single-cohort design. The use of an equal cost sample size allows for ALDs to have N’s that are 10-85% larger than in the single-cohort design, thereby offsetting the potential loss of power in the ALD. We subsequently utilize Monte Carlo simulation methods to demonstrate how the statistical power and bias in the ALD is comparable to that of the single-cohort design for both linear and nonlinear models and discuss considerations for when between-cohort differences in development are present. Lastly, we use data from the National Longitudinal Survey of Youth (NLSY 1997) to demonstrate the ability of an ALD to capture within-person changes using real data. The NLSY has the structure of an ALD such that data from multiple birth cohorts are collected over the same period of time. We demonstrate the benefits of capturing between-cohort variability in the modeling process using data on marijuana and tobacco use from the ages of 12 to 30. We additionally discuss considerations for the modeling of cohort membership and alternate strategies for cohort inclusion. Results from the simulations and in the NLSY suggest that ALDs should be the preferred longitudinal design for researchers studying age-related development.

**Centered-ANCOVA: A Solution for Lord’s Paradox with Implications for Valid Causal Inferences in Longitudinal Analyses**

*Hua Lin & Robert E. Larzelere*

Developmental science is fundamentally about describing and explaining between-person differences in within-person change, yet there is little consensus about analyzing change. Lord’s (1967) paradox demonstrated contradictory results from analyses of simple gain scores (e.g., linear growth models) and residual gain scores (e.g., ANCOVA, multiple linear regression). Discussions have focused on which approach, if either, produces unbiased causal estimates (Huitema, 2011; Van Breukelen, 2013). This study used simulated data to compare the results when the correct causal effect is known. One dataset was simulated in which simple gain scores give the correct conclusion (supporting the null hypothesis) and one in which ANCOVA gives the correct conclusion. Previous simulation results showed that analyses of the two types of gain scores differ from each other only when the pretest group means differ, which violates a rarely recognized ANCOVA assumption (Lin, Larzelere, & Washburn, 2018). This study also varied the pretest and posttest means for one group while keeping the other group the same to clarify when analyses of the two types of gain scores will differ and by how much. We also introduce centered-ANCOVA and apply it to the simulated data and to analyses of treatments for depression.

**Method:** By mimicking Lord’s (1967) paradox, the simulated data generated 1000 students (50% girls) to compare gender differences in weight gained during one year. The specified pretest and posttest weights were M = 130 and SD = 15 for girls and M = 160 and SD = 15 for boys, identical at pretest and posttest. The within-group auto-regressive correlation between pretest and posttest was r = .48. For comparison, a reversed version of Lord’s paradox was simulated, with the same pre-test means and SDs, but post-test means of 152.2 for boys and 137.8 for girls, to fit ANCOVA’s null hypothesis. Centered-ANCOVA was implemented by centering both pretest and posttest scores around pretest group means.

**Results:** Varying the pretest and posttest means of one group showed that the difference between the effect sizes in analyses of the two types of gain scores was an exact function of the difference between the pretest group means and the within-group auto-regressive coefficient. As expected, the results showed that analyses of simple gain scores produced the correct causal effect in Lord’s paradox, but ANCOVA produced the correct causal effect for reversed Lord’s paradox. Centered-ANCOVA produced robust consistency with the same effect size as simple gain scores, which is unbiased only if analyses of simple gain scores are unbiased. Centered-ANCOVA also produced consistent results for
analyses of two treatments for depression from the Fragile Families data and removed the adverse effects otherwise indicated by ANCOVA. Unbiased longitudinal causal estimates are approximated (1) if the groups being compared have equal pretest means, (2) their auto-regressive correlation is $r = .00$, or (3) the analysis correctly models a no-treatment effect in its null hypothesis.

The Discover and Fix Method for Analyzing the Longitudinal Experiment: Controlling QRPs and Incorporating Pre-registration

John Protzko

Experiments with longitudinal follow-up provide the absolute strongest tests of developmental theories; for testing causality in a developmental context, there is no better method. Longitudinal experiments also carry with them a great practical utility, providing extensive long-term funding and publications for the investigators. Unfortunately, this makes longitudinal experiments a breeding ground for p-hacking and Questionable Research Practices (QRPs). There is a larger incentive to show the intervention ‘worked’ that is stronger than simply a need to publish, in order to keep longitudinal funding possible. Dozens of measures are taken over a long period of time with no correction for multiple hypothesis testing, inflating type I errors.

The prospect of incorporating pre-registration into such longitudinal interventions and developmental work is threatening to the utility of longitudinal studies. Analyzing the longitudinal experiment using traditional best practices for covering multiple testing type 1 error inflation can also lead to different results if the study is analyzed as data collection come in versus whether the data is secondarily analyzed after the experiment is done.

Here we propose a method for analyzing the longitudinal experiment that protects the findings that are present while preventing the spurious creation of results. This method incorporates pre-registration and protection from type I error inflation from multiple testing while being able to provide the same results whether the study is analyzed as results come in or analyzed all at once. This method of discovering and ‘fixing’ results over time provides a way to bring pre-registration to longitudinal experiments, protect against such questionable practices as p-hacking, salami slicing, selective reporting, and protect the overall findings of such experiments from inflated type 1 errors.

The method proposes that numerous pre-registrations happen over the course of data collection instead of one all at once. Data collection is organized into bins or waves of data collection. Each wave is then analyzed once data collection has finished only including those and all previous bins. When future bins are collected the means and variances and parameter estimated resulting from the previous bins are fixed and the new data from the resulting bin is freely estimated into one concurrent model. Provided the bins are decided a priori, this allows for secondary data analysis to follow the exact same procedures and return the same results as would be seen with analyses during longitudinal data collection. This ‘discover and fix’ method also allows for consistent estimation across all dependent variables, opposed to data being sliced into separate papers and different functional forms and covariates added or dropped in each new analysis.
Dynamic Measurement Invariance using Dynamical Systems Approaches: The Measurement Model of Derivatives

Ryne Estabrook

Developmental and longitudinal statistical models must rest on valid and reliable measurement. However, common methods for evaluating measurement are not sensitive to the needs of developmental psychology. Most common methods build on the assessment of dimensionality and measurement structure at a single occasion, thus relying entirely on between-person differences. These methods cannot account for how individuals change, instead resting on ergodic assumptions that between-person differences represent the same structures that govern within-person variation (Molenaar, 2004).

This talk consists of a description and application of the measurement model of derivatives (MMOD; Estabrook, 2015), a method for longitudinal measurement evaluation that directly utilizes within-person change. This method consists of two parts: a data transformation that creates observed or latent item derivatives that represent different types of within-person change; and a factor analytic measurement model that evaluates the structure of those item-level changes. This data transformation yields interpretable item-level derivatives that can be adjusted for individual differences in the timing of observations, making them sensitive to participants actual ages and other indices of developmental time. Simulation studies show that this model can recover discrepant measurement structures for between- and within-person differences.

This model is then applied to the measurement structure of physical fatigue. Fatigue is a construct that is relevant to both normative and varied diseased populations across the lifespan and is an important outcome of a variety of treatments (Yellen, et al, 1997). Despite the utility of this construct, measurement models of fatigue constructs are subject to the same methods and limitations of other developmental measures. We evaluate the measurement structure of the FACIT-Fatigue scale in three randomized control trials across different populations and treatments, each with between three and five longitudinal assessments.

Results show that traditional cross-section measurement evaluation yields the same unidimensional structure commonly used. However, longitudinal extensions of this structure reveal misfit (CFI=.858, RMSEA=.082). Application of MMOD shows that non-zeroth derivatives (i.e., change scores) yield a two-factor structure matching Cella, Lai, & Stone’s (2011) split of the scale into experience and impact subscales. These two subscales correspond with the somatic experience of fatigue and its limitation on daily activities. Experience and impact are highly correlated (r=.82), but respond differentially to treatment, with the experience subscale showing higher effect sizes at four weeks (d=.49) than the impact subscale (d=.33).

Thus, MMOD reveals more nuanced and sensitive measurement structures than shown in more conventional cross-sectional analyses. When constructs are hypothesized to change, measurement evaluation must directly address this change, and items that load on the same construct must show concordant changes consistent with a dynamic construct. Additional recommendations for use are discussed.
Accounting for Standard Errors of Measurement in Change Modeling

Kevin J. Grimm, Kimberly Fine, & Gabriela Stegmann

Modeling within-person change over time and between-person differences in change over time is a primary goal of developmental scientists. When modeling change in a observed score over time with multilevel or structural equation modeling approaches, there is an assumption that each observed score is equally reliable. However, when examining reliability with item response modeling methods, it is clear that observed score reliability can vary - sometimes greatly vary. When modeling change over time, it is the case that this variability in reliability can vary both within a given participant's scores over time and across participants scores at any point in time. In this paper, we propose an approach to account for score reliability when modeling change over time and compare this approach to modeling change (1) without accounting for this variability, (2) fitting a change model with an underlying item response model, (3) using level-1 weights, and (4) using a combination of level-1 and level-2 weights in multilevel modeling. The results highlight how parameter estimates can vary over these methods and that parameter estimates obtained using the proposed approach can map onto estimates obtained when fitting a change model with an underlying item response model, which is considered an optimal approach.

More Efficient Estimation of Derivatives for Visualizing Dynamical Systems

Pascal R. Deboeck

The dynamical systems literature is rich data visualizations techniques, which have allowed for new insights into the processes of many systems. In psychology, the rich complexity of intraindividual variability may benefit from such visualization techniques. Vector field plots, for example, offer the potential for exploratory examination of the relations between constructs. By including derivatives in vector field plots --- the change in a construct with respect to another variable such as time --- relations between the levels (0th derivatives), velocity (1st derivative), and higher order derivatives (e.g., acceleration, jerk) can be explored. While readily accomplished on data with high sampling rates relative to the rates of change of the underlying construct, such as physiological data, the application of vector field plots to psychological data (e.g., diary data, ecological momentary assessments) has been more challenging due to the number of observations, the sampling rate, the use of non-continuous scales (e.g., a small number of likert scale items), and the measurement error in these scales. The latter poses particular problem, as measurement error compounds as higher orders of derivatives are estimated, resulting in plots that are often too noisy for insights to be gained. This presentation will introduce a new method for estimating derivatives that is more efficient than other commonly used approaches, and can be applied to non-continuous data such as the ordinal outcomes of likert scale items. Applications to substantive data will be presented.

Continuous and Discrete Time: Different Inferences from the Same Multi-Wave Data

Pascal R. Deboeck

Time is unlike other dimensions sampled in the social, behavioral, and medical sciences. People and many variables come in distinct units. Between any pair of observations made across time, however, are an arbitrary number of additional samples that could have been sampled. While sampling across time is always discrete, the underlying dimension is continuous. This incongruity has led to differing perspectives on how repeated observations should be modeled. In some common models, the unobserved interstitial samples are ignored, while in other models these unobserved samples are
explicitly considered. This presentation will provide an introduction to two perspectives of how repeated observations can be modeled. Substantive data relating longitudinal measures of Anxiety, Depression, and Social Competence will be presented and analyzed using both discrete and continuous perspectives of time. The example will allow for a comparison of the inferences that can be made using these differing perspectives on time.

**Using Response Times from High-stakes and Formative Test to Estimate Abilities and to Compare Groups**

*Daniel B. Wright*

Many high- and low-stakes tests are taken online and often item response times are available. Response times provide a window into cognitive strategies used by students as well as a different perspective from accuracy about the students' ability. Many models, particularly in cognitive science, exist that account for the relationship between response time and accuracy in laboratory research. Information from the response times is valuable for those in education. This paper focuses on two questions.

The first question is: can response times be used to improve ability estimates? High-stakes fixed-time (ACT) data were used to compare van der Linden's (2007) hierarchical model, a diffusion model (a simplification of Ratcliff’s model, Wagenmakers et al., 2007), and treating all rapid responses as errors (TARRE), with traditional 2PL and 3PL IRT models. Accuracy was assessed using leave-out-one-item cross-validation. The TARRE procedure, treating all responses made in less than ten seconds as errors, produced the most accurate ability estimates. The improved accuracy was comparable to accuracy gained by adding an extra item to the test, so small, but still of substance. The TARRE procedure was examined in a second study using a years worth of responses on formative assessments (tens of thousand of assessments) from a learning system at two high schools. While TARRE did improve ability estimates, the improvement is less for these untimed self-regulated tests than for the high-stakes fixed-time ACT. Recommendations are made for both of these test types. In particular, making sure formative test items require some depth of processing and requiring students to take enough time to create a thoughtful answer on these items would increase the value of these assessments.

The second question examined was whether there were speed gaps among different groups of students and whether these showed a similar pattern to achievement gaps. Speed gaps are important to test developers to ensure that certain groups of students are not overly burden by certain items. They are also important in the classrooms because the amount of time taken by students is to some extent under their control. Therefore interventions can be designed to change the time spent. For example, using the data from the two high schools, boys tended to answer questions more quickly than girls, but girls had higher achievement scores. This can be due to boys being more over-confident in their answers than girls and thus believing that they have reached a satisfactory answer more quickly than girls. Could an intervention that improved students’ calibration lessen both the speed and the achievement gaps? I also discuss the speed gaps based on English Language Proficiency and on ethnicities. Recommendations for accommodations and training are discussed.

**Using Machine Learning to Identify Time-Invariant and Time-Varying Covariates Predictive of Longitudinal Outcomes**

*Gabriela M. Stegmann & Kevin J. Grimm*

In longitudinal research, a common goal is to identify predictors of a behavior, whether these predictors are time-invariant (person-level predictors, such as gender or history of an individual prior to the study) or time-varying predictors (observation-level predictors, such as behaviors that may change across time and that are assessed repeatedly throughout the study). For instance, in substance abuse research the goal may be to predict drinking behavior in adults by using information collected at the beginning of the study (i.e., gender, race, characteristics of the individual) as well as information collected throughout the study at each assessment (i.e., behaviors related to other drug usage, crime, relationships to family and friends throughout the study).
Longitudinal recursive partitioning (LRP) is a machine learning method that combines recursive partitioning (also known as decision trees) with mixed-effects models in order to identify groups of individuals following similar longitudinal trajectories. It uses time-invariant predictors that split data into nodes, where each node consists of a mixed-effects model that represents the growth curve of those individuals. A second stage is added to LRP which includes time-varying predictors: once individuals are assigned to their terminal nodes after the LRP is fit, the difference between the predicted value according to the growth curve at the node and the actual value of the outcome (i.e., residual) is extracted for each individual at each time point. A new tree is fit using the time-varying covariates to predict these residuals.

Therefore, this method (1) groups individuals with similar trajectories together based on time-invariant predictors and (2) identifies time-varying predictors of the outcome that could not be predicted by the growth curve based on time-invariant predictors alone. This method is meant to be implemented in substantive research where the interpretation of results is of interest to the researcher.

Model Comparison and Selection for Mediation with Zero-Inflated Count Outcomes

Holly P. O’Rourke

Many studies of human development are concerned with examining mechanisms or intervening variables in addition to ultimate outcomes. Researchers often use mediation analysis to achieve this aim. Mediation analysis is inherently longitudinal, given the temporal precedence assumption that the mediation process is expected to unfold over time. Mediation methods have been developed for different types of outcomes, including continuous, count, and binary outcomes (Coxe & MacKinnon, 2010; Geldhof, Anthony, Selig, & Mendez-Luck, 2018, MacKinnon, 2008). However, less research has addressed mediation with zero-inflated (ZI) count outcomes, and the approaches thus far developed for mediation with count outcomes are not easily extended to models for ZI counts, which model zeroes and counts in the outcome separately and split the mediated effect into two parts. The goal of this talk is to describe how to conduct mediation analysis for ZI count outcomes, and to call attention to the specific issues that arise when count outcomes are ZI. A method is described to assess mediation for ZI count outcomes that is applicable for a variety of generalized linear models (GzLMs), including ZI Poisson (ZIP), ZI negative binomial (ZINB), and hurdle models. Once an appropriate ZI GzLM is selected, mediated effects can be calculated for these models and tests of mediation can be conducted. The differences between mediation for ZI and non-ZI GzLMs are highlighted using several examples. Future directions are discussed, including extensions to longitudinal models.

Preventing Child Maladjustment by Improving Parents’ Emotion Socialization: A Randomized Controlled Trial of a Military Parenting Intervention

Na Zhang, SunKyung Lee, Jingchen Zhang, Timothy Piehler, & Abigail Gewirtz

Studies have linked parental military deployments to children’s adjustment problems including anxiety and somatization (Lester et al., 2010; Swedean et al., 2013). These problems may worsen during adolescence and/or adulthood, if unattended. Eisenberg, Spinrad, & Cumberland (1998)’s model of parental emotion socialization (ES) suggests that emotion-related parenting practices (e.g., reactions to child’s negative emotions) influence child emotion regulation capacities, which relate to child mental health outcomes (Morris, Criss, Silk, & Houltberg, 2017). Substantive data lent
support to this model, however, few studies have focused on military families. {Author names masked for review} (2018) investigated the effects of a parenting intervention, known as After Deployment Adaptive Parenting Tools (ADAPT), on ES, showing that mothers, but not fathers, reported enhanced ES at 6-months follow-up if they were randomized into the intervention (vs. control). Using family-level data and latent growth modeling, we tested the intervention effects of random assignment to the ADAPT program on mothers and fathers’ ES and child outcomes over 2 years. We hypothesized that mothers and fathers in the intervention (vs. control) condition would show improvements in ES over time, which would be associated with fewer child adjustment problems. Methods: Secondary data from a randomized control trial of ADAPT were used in the current study. The sample included 271 two-parent families (primarily White and middle class) with at least one deployed parent and one target child aged 4-12. ES was self-reported using the Coping with Children’s Negative Emotions Scale (Fabes et al. 2002) at baseline, 1-year, and 2-years post-baseline. Child adjustment problems were assessed through parent-reports at baseline and 2-years follow up using the Behavioral Assessment Scale for Children (BASC-2; Reynolds & Kamphaus, 2004). Latent growth models were computed utilizing an ES variable ( nonsupportive or supportive ES) for both mothers and fathers and child outcomes of internalizing or externalizing behaviors. Results: Model fit indices were acceptable. Results showed that mothers and fathers in the intervention group (vs. control) had greater improvements (i.e., greater negative slopes) in nonsupportive ES, and mothers’ improvements were associated with reductions in child externalizing and internalizing behaviors over 2 years. The intervention did not have an impact on mother or father supportive ES over time. Conclusion: The intervention was effective in improving paternal and maternal nonsupportive ES over 2 years. Mothers’ nonsupportive ES changes were associated with child externalizing and internalizing outcomes. Discussion: Mothers and fathers play different roles in caregiving, in particular, regarding the socialization of emotions. More research is needed to understand the relationship between fathers’ ES and child outcomes in military families.

Less is More: Emotion Regulation Deficits in Military Fathers Magnify their Benefit from a Parenting Program

Jingchen Zhang, Na Zhang, Abigail Gewirtz, & Timothy Piehler

Combat deployment and exposure to traumatic events may cause deficits in emotion regulation, thus impairing military parents’ capacities to respond effectively to children’s emotions. This is a particularly salient issue for fathers – who comprise the majority of service members – following deployment to war. Evidence-based parenting programs have been developed to improve parenting practices in military families, however, little is known about the role of parents’ emotion regulation on the effectiveness of the parenting program. Using data from a randomized controlled trial, this study examines the effects of the After Deployment, Adaptive Parenting Tools (ADAPT) program, on observed emotion related socialization behaviors (ERSBs, Eisenberg et al., 2001), and whether self-reported emotion regulation of service member fathers affects program outcomes. This study used a subset of data from the ADAPT study, which included 181 fathers (M age = 37.76, SD = 6.42) in 2 parent families who had been deployed to recent conflicts and who had at least one 4-12-year-old child living in the home. Family interaction tasks were videotaped and coded using the Macro-Level Family Interaction Coding System (MFICS; Snyder, 2013). Four domains of emotion-related socialization behaviors were assessed: positive engagement, withdrawal avoidance, reactivity-coercion, and distress avoidance. Structural equation modeling was used to examine the intent-to-treat effect of the ADAPT program on observed effective parenting 1 year post-baseline, the moderating effect of self-reported emotion dysregulation at baseline, and the mediating role of emotion dysregulation at baseline at 1-year post-baseline. Results showed that the intervention did not directly improve fathers’ observed ERSBs relative to the control group. However, fathers’ emotion dysregulation at baseline was found to moderate the intervention effect on reactivity coercion and distress avoidance. Fathers with higher levels of baseline emotion regulation difficulties (i.e., about 0.5 SD above mean, which was approximately 25% in the sample) had significantly greater decreases in reactivity coercion and distress avoidance in intervention group relative to control group. Moreover, fathers’ emotion dysregulation at 1 year post-baseline were found to mediate the intervention effect on observed reactivity coercion, and the mediation effect was moderated by emotion dysregulation at baseline. Specifically, for fathers with more deficits in emotion regulation at baseline (approximately 25% in the sample), the
intervention significantly decreased their reactive and coercive parenting practices and the effect was mediated through reductions in their emotion dysregulation. These findings may have important implications for the development of future evidence-based parenting programs.

**Paper Session 2.2**
Friday, September 28, 1:15-3:00pm, Continental Divide

**Combining Data Sets through Integrative Data Analysis: The What, Why, and How**

*Sara K. Johnson & M. B. Weiner*

Integrative data analysis (IDA), developed by Curran, Hussong, and colleagues (e.g., Curran et al. 2008; Curran & Hussong, 2009), is an overall approach to data analysis that focuses on pooling raw data from existing studies in order to fit one model to the aggregated data. The development of this approach was inspired in part by the proliferation of short-term longitudinal studies about development in various contexts and across the lifespan. On their own, these studies are often limited in their ability to model the processes of interest due to low power or relatively brief time spans in which to model change. In their “ongoing quest to build a cumulative psychological science” Curran (2009, p. 7) and colleagues proposed statistical techniques that may be useful in building a cumulative science of lifespan human development by linking multiple independent samples. These techniques have tremendous potential to advance the social and behavioral sciences by taking advantage of data that have already been collected, yet they remain underutilized. One potential reason is that many researchers may be intimidated by such techniques, and few applied examples are available to provide practical guidance that is understandable to applied researchers. In this presentation, we will 1. introduce the IDA approach, 2. illustrate how it can be applied using examples from our research, and 3. provide guidelines for participants to consider how they could incorporate IDA into their work. To introduce IDA, we will describe the situations in which IDA may be useful and the basic steps of IDA. We will structure these descriptions with illustrations from IDAs we have published (Authors, 2017; Authors, 2018) and others for which we are preparing manuscripts. These IDAs are focused on the nature and development of character virtue attributes.

The general procedure we will present is the one we have followed in our IDAs, as follows. IDA begins with the identification of an overarching research question or ultimate analysis aim, which guides the initial selection of the larger pool of studies from which the eventual final group of studies is chosen. Then researchers determine which measures to include of the constructs of interest, guided by several concerns and potential challenges (which we have experienced and will address). Then, researchers prepare the data set. This process differs depending on the structure of the data sets and the eventual aim of the IDA, but we will illustrate issues that we encountered, which are likely to be relevant for many IDAs. One challenge we encountered was how to present our results in a succinct way that addressed the overall research aim but provided sufficient details to address the variability in our findings due to the studies that were included. We will provide several examples of our methods for addressing that challenge.

During the presentation, we will guide attendees in developing a preliminary plan for their own IDA. We will create a list of questions that participants can answer as they follow along with our presentation. At each step, they will contemplate their answers to these questions to help them develop plans for how they might use IDA, and what challenges they may encounter.
Lag as Moderator Meta-Analysis (LAMMA): A Methodological Approach for Synthesizing Longitudinal Data

Noel A. Card

Longitudinal data are common and essential to understanding human development. This paper introduces an approach to synthesizing longitudinal research findings called lag as moderator meta-analysis (LAMMA). This approach capitalizes on between-study variability in time lags studied in order to identify the impact of lag on estimates of stability and longitudinal prediction. The paper introduces linear, nonlinear, and mixed-effects approaches to LAMMA, and presents an illustrative example. Several extensions of the basic LAMMA are considered, including artifact correction, multiple effect sizes from studies, and incorporating age as a predictor. I will also seek to extend the LAMMA approach toward other papers in the symposium, if possible. I will discuss thr It is hoped that LAMMA provides a framework for synthesizing longitudinal data to promote greater accumulation of knowledge in developmental science.

A Comparison of Bayesian Synthesis Approaches for Comparing Two Group Means

Han Du, Thomas N. Bradbury, Justin A. Lavner, Andrea L. Meltzer, James K. McNulty, Lisa A. Neff, & Benjamin R. Karney

In developmental psychology, the pretest-posttest comparison group design is one of the most widely used methods to evaluate changes, in which matched group means tests are applied. And some developmental research questions involve comparing two independent groups, such as comparing girls' scores to boys' scores. When there are multiple studies on the same research topic, researchers may want to synthesize the studies to draw statistical conclusions and plan sample size for a future study. The most popular synthesis approach is a meta-analysis, but there are few discussions or applications of other synthesis approaches. Thus researchers might not be aware of nor appreciate the other methods' strengths. In addition, the existing synthesis approaches mainly focus on frequentist modeling, and the merits of Bayesian data synthesis approaches are ignored.

Therefore, we provide the statistical models and the corresponding R code for several Bayesian synthesis approaches, and discuss when and how to use these Bayesian synthesis approaches to combine studies that compare two independent or matched group means. Specifically, besides the meta-analyses that are widely known, we present integrative data analyses, where multiple datasets are merged into one big dataset and then traditional data analyses are applied. We present the data fusion using consequential data-dependent priors (DFCDP) approach, in which each study's information contributes to the inference sequentially. In addition, we introduce the data fusion using aggregated data-dependent priors (DFADP) approach that uses multiple studies to construct aggregated informative priors. For each of the methods (i.e., meta-analyses, integrative data analyses, DFCDP, and DFADP), based on whether considering between-study heterogeneity and/or covariates, fixed-, random-, and mixed-effects models with other variant models are illustrated with real data.

We summarize the strengths and limitations of each approach based on the real data. Since each method has its own pros and cons, researchers should make a decision according to their research questions, data structures, and our summarized features of Bayesian synthesis approaches. Furthermore, all the Bayesian synthesis approaches can provide Bayesian power with assurance level and expected power, which would facilitate sample size planning.
**Heterogeneity in Longitudinal Changes with Different Turning Points: A Comparison with Traditional Approaches**

*Chair: Kandauda A. S. Wickrama*

To investigate heterogeneity in longitudinal changes, developmental researchers have used Growth Mixture Modeling (GMM). However, as research increasingly indicates that individuals’ developmental changes are complex, and a proper analysis of change often warrants advanced longitudinal modeling. Piecewise Linear-Linear Growth Mixture Modeling allows researchers to investigate segmented changes in individual attributes over time where the data come from a mixture of two or more unobserved subpopulations. This approach has the advantage of allowing developmental researchers to investigate important turning points (known as “knots”) of trajectories and how these turning points are linked to specific life transitions.

The current series of presentations will provide step-by-step instructions introducing and applying this piecewise linear-linear growth mixture modeling approach to developmental research. The first presentation serves as a foundation to introduce growth mixture modeling (GMM) using data on depressive symptoms from adolescence to young adulthood. The second presentation focuses on piecewise linear-linear growth mixture modeling with a “known knot” approach. The third presentation focuses on piecewise linear-linear growth mixture model with an “unknown knot” approach. In addition, we also incorporate a discussion of how findings related to antecedents and outcomes of these depressive symptom trajectories vary across these two approaches along with Mplus syntax for all models. Longitudinal panel data from 499 adolescents (mean age = 13.5, 53% female in 1990) who participated in the Family Transition Project (FTP) over 11 years from 1990-2001 (P.I. Rand Conger) were used. Ten-items from the SCL-90-R (Derogatis & Melisaratos, 1983) were used to measure depressive symptoms.

**A Growth Mixture Model of Depressive Symptoms**

*Catherine W. O'Neal*

Developmental studies have consistently reported longitudinal changes in depressive symptoms from adolescence to young adulthood using a latent growth curve modeling (LGCM) approach. However, an assumption inherent to LGCM is that all individuals are drawn from the same population and share the same functional form of growth. This assumption is not practical in situations where the data come from a mixture of two or more unobserved subpopulations. For instance, some individuals may experience a decrease in depressive symptoms over time whereas others experience an increase. In this example, these two sub-populations show distinct trajectories with varying rates of change across the study period.

In structural equation modeling (SEM), estimating heterogeneity in depressive symptom trajectories with unobserved subpopulations requires an extension of LGCM in order to include a categorical latent class variable. Known as a growth mixture model (GMM), this statistical method incorporates latent classes into a LGCM (Muthen, 2002). More specifically, a GMM is a type of multivariate normal mixture model that allows distinct growth parameters (means and variances) across classes. The main purpose of the first presentation is to illustrate growth mixture modeling using the example of depressive symptoms over a period of 11 years (utilizing data from the FTP; P.I.: Rand Conger) as a foundation for subsequent presentations.
Furthermore, consistent with the life course framework (Elder, 1998), early adversities may lead to the formulation of distinct mental health trajectories in adolescence, which, in turn, can result in negative socioeconomic and health outcomes in young adulthood. To test this possibility, covariates can be added as predictors and distal outcomes into a GMM. Previous studies have often extracted the derived class membership variable from a GMM into another statistical program, such as SPSS, and utilized the class membership variable as an observed nominal variable for additional analyses. This approach fails to account for the uncertainty of classification (measurement errors) and instead conceptualizes these unobserved subpopulations as observed populations. By failing to account for measurement error, this approach frequently underestimates the associations between latent classes and other covariates (Feingold et al., 2014). Alternatively, to estimate more unbiased associations, methodologists have suggested a 3-step approach, which accounts for this measurement error. In this presentation, this 3-step approach is introduced in an investigation of possible antecedents and outcomes of class membership. All analyses are conducted using the Mplus program with full-information maximum likelihood estimation (FIML) to manage missing data (Enders, 2002).

Model fit indices of the GMM show the three-class model is optimal (AIC / SSABIC = 4257.916 / 4274.717, LMR-LRT = 137.37, p < .05). Classes include symptoms that are a) high and decreasing (n = 77, 17.2%), b) low and increasing (n=15, 3.3%), and c) low and decreasing (n = 357, 79.5%). Estimated mean profiles of early adversities and later consequences show that youth in two of the classes (high and decrease; low and increase) experienced not only more early adversities, but also more negative consequences compared to those in the low and decreasing class.

A Piecewise Linear-Linear Growth Mixture Model of Depressive Symptoms with a Known Knot Approach

*Kandauda A. S. Wickrama*

Developmental studies have suggested that depressive symptoms generally increase during early to mid-adolescence and then decline during the transition from late adolescence to young adulthood (e.g., Wickrama et al., 2009). This suggests distinct phases of development in depressive symptoms over time. The piecewise linear-linear LGCM, which is an extension of a standard LGCM, allows researchers to specify distinct phases of “growth” (or change) in order to conform to a particular functional form of the overall change process (Cudeck & Harring, 2010).

An interesting feature of a piecewise linear-linear LGCM is the time point at which the response function transitions from one phase to another. This transitional period is known as the “knot” or turning point (Cudeck & Klebe, 2002). This knot can be known a priori (from previous findings for instance), or the knot can be defined by directly examining observed scores of repeated measures in the data to identify trends (a known knot approach). As an example, previous studies have consistently suggested that emerging adulthood (age 18 to 25) is a sensitive period for changes in mental health due to the multiple transitions that often occur during this life stage (e.g., employment, living independently, financial independence, marriage, and parenthood). Consequently, we anticipate that in a piecewise linear-linear LGCM the knot of depressive symptom trajectories exists between adolescence and young adulthood (ages 18 to 25; Schulenberg & Schoon, 2012).

Using SEM, a piecewise linear-linear LGCM can be extended to a piecewise linear-linear GMM, which allows for an investigation of distinct trajectories within a specific developmental phase with a transition-linked knot. Consequently, the ability to estimate piecewise linear-linear GMMs allows developmental researchers to address novel and cutting-edge research questions, providing new insight on dynamic changes over time. Taken together, there are two purposes of this presentation. First, we illustrate a piecewise linear-linear latent growth curve model, including the Mplus syntax and output, and emphasize the interpretation of these findings. Second, we compare covariate associations in these GMMs when estimating the model with and without knots to provide insight on how to select the best model.

First, a knot point was examined by checking observed mean scores across all time points. We found that means increased until 1996 (median age= 18 years) and then decreased until 2001 (median age = 25 years). Based on these mean changes, we set 1996 as a known knot in a piecewise linear-linear GMM. Model fit indices of piecewise linear-
linear GMM showed the three-class model remained optimal (AIC / SSABIC = 4273.181 / 4291.849, LMR-LRT = 101.113, p < .05). Classes included symptoms that were a) recovering (n = 53, 11.8%), b) escalating (n = 14, 3.1%), and c) normative (n = 382, 85.1%). Estimated mean profiles of early adversities and later consequences were similar to findings from the GMM. Youth in two-class trajectories (recovering and escalating) experienced more early adversities and poorer outcomes, including negative socioeconomic and health consequences, compared to those in normative class.

A Piecewise Linear-Linear Growth Mixture Model of Depressive Symptoms with an Unknown Knot Approach

Tae Kyoung Lee & Kandauda A. S. Wickrama

Past developmental findings have utilized a piecewise function to identify developmental processes involving a turning point for depressive symptoms between adolescence and young adulthood (Jager 2011). However, these findings assumed that the same timing of the turning point, or knot, in depressive symptom trajectories for all youth (a known knot approach). This assumption can be suspended in mixture longitudinal modeling. For example, some youth may experience fast increases in depressive symptoms during early adolescence (early timing of turning point) and then decreasing trajectories until young adulthood, whereas other youth may experience stable levels of depressive symptoms until late adolescence but fast increase during the transition period to young adulthood (late timing of turning point). These distinct trajectory possibilities with variations in the timing of turning points can be directly tested using a piecewise linear-linear GMM with an unknown knot approach. The first purpose of this presentation is to illustrate this piecewise linear-linear GMM with an unknown knot approach.

Methodologically, detecting an unknown knot in a piecewise linear-linear GMM may provide a more accurate (i.e., valid) classification, which may be more strongly linked to early adversities and later developmental consequences compared to classifications derived from traditional GMM approaches (i.e., no knot and known knot approaches). Thus, the second purpose of this presentation is to test the validity of the derived classification in a piecewise linear-linear GMM with an unknown knot approach by incorporating the same covariates used in the previous two presentations. For model specification to detect an unknown knot in a piecewise linear-linear GMM, six potential knots were specified within each class trajectory (1991, 1992, 1994, 1995, 1997, and 1999) as the full class model. For the model selection process, the reduced models were then evaluated by dropping the smallest class size (a backward selection approach). For model identification, covariances among growth factors in the model were fixed to 0.

The results show that a piecewise linear-linear GMM with three different knots had the optimal fit (AIC / SSABIC = 4200.595 / 4219.264) as this model had the lowest IC statistics. The majority of youth showed an inverse U-shaped pattern of depressive symptoms with 1994 (median age = 18 years) as a turning point (n = 350, 77.8%). 15.1% (n=68) of youth had an early turning point with trajectories that increased until 1991 (median age = 15 years) and then decreased until 2001 (median age = 25 years). 6.9% (n = 31) of youth had a late turning point with trajectories that were moderate and stable until 1999 (median age = 23 years) and then increased relatively rapidly until 2001. Moreover, these three classes were linked to more covariates (including early adversities and subsequent negative consequences) compared to the no-knot GMM and the GMM with a known knot approach, which provides evidence for the existence of distinct turning points in youth depressive symptoms trajectories.
Measurement Invariance in Latent Transition Analysis

Katherine E. Masyn

Compared to the vast and ever-growing psychometric research corpus regarding measurement invariance (MI) and differential item functioning (DIF) in the SEM and IRT spheres, there is a relative scarcity of work addressing these issues in finite mixture modeling (cf., Masyn, 2017). The majority of the scant existing work on measurement invariance in latent class and latent profile analysis has been done in the context of multiple-group models. Collins and Lanza (2013) describe a general procedure for invariance testing within an LCA, which involves first determining that the number and general pattern of item endorsements is similar; this is generally done by conducting separate LCAs by group and using standard fit indices (e.g., BIC, AIC, likelihood ratio test) to determine the optimal configuration of classes within each group. After this initial step, testing generally proceeds as in the continuous latent variable case, by successively testing constraints in a multiple-group LCA. There is some evidence (Finch, 2015) that, within this general procedure, comparisons to the baseline model should be made using a fit index which makes minimal assumptions, such as the bootstrap likelihood ratio test (BLRT). However, there is little evidence as to which choices yield optimal detection of non-invariance in the multiple-group approach.

This paper presents the parameterization of measurement non-invariance in multiple-group latent class analysis (MGLCA). I discuss the translation of the standard levels of measurement invariance from the traditional multiple-group confirmatory factor analysis (MGCFA; a la Meredith, 1993)—configural, weak, strong, and strict—to the MGLCA setting and explore the meaning of “partial invariance” at these different levels in the case of a latent class measurement model. I demonstrate my recommended MGLCA measurement invariance testing procedure with a data from Wave 1 (1994-1995) of the National Longitudinal Study of Adolescent Health (Add Health; Harris, 2013). Following the Collins and Lanza (2013) empirical example of latent class analysis of adolescent delinquency, I use six dichotomized student questionnaire items about past-year delinquent behavior as indicators of a 4-class latent multinomial variable. Student sex (binary) was considered as the grouping variable of interest.

The MGLCA parameterization of measurement non-invariance is then extended to the latent transition analysis (LTA) framework for the evaluation of longitudinal invariance. I demonstrate my recommended LTA measurement invariance testing procedure using the Add Health data from Waves 1-4 with the same LCA measurement model at each wave as was used for the MGLCA illustration. For both the MGLCA and LTA examples, empirical comparisons are made to demonstrate the potential consequences of failing to account for measurement non-invariance, including bias in structural parameters estimates and standard errors. I close with a discussion of future directions, including the adaptation of these procedures for the testing of approximate measurement invariance or measurement equivalence using Bayesian estimation.

A Latent Transition Analysis of College Student Suicide Risk Trajectories Predicted by Depression and Anxiety Symptomatology

Nicholas J. Parr & John R. Seeley

Suicide is a major public health concern, with significant increases in the rates of suicide among all age groups and across 44 U.S. states over the last two decades, as recently announced by the Centers for Disease Control and Prevention (Stone et al., 2018). At particular risk for suicide are college students, among whom suicide is the second leading cause of death (American Psychological Association, 2011). Across the country, colleges and universities are implementing screening and intervention approaches in an effort to increase access to mental health care and reduce suicide attempts among students. Yet, improvements can be made in understanding the likelihood of individuals attempting suicide over time, particularly as a function of anxiety and depression symptomatology. Clarity on suicide risk trajectories for college
students over the course of a typical 4-year college enrollment would yield important policy, programmatic, advocacy, and education benefits, including facilitating implementation of better targeted prevention activities, universal prevention efforts focused on key risk factors (e.g., academic stress), and improved faculty and staff education programs with the goal of earlier identification of at-risk students. One methodology which can be applied to address the need for insight into suicide risk over time is latent transition analysis with moderator analysis. In this presentation, we will describe the results of a latent transition analysis (LTA) with moderator analysis performed on four-year longitudinal data drawn from a National Institutes of Health-funded R01 study (N = 972 at Time 1) which tested an acceptance and mindfulness-based group intervention to prevent suicidality among college students. In the context of these data, the benefit of LTA is that it allows modeling of individuals' membership to latent classes of suicide risk based on responses to a single metric such as the Suicidal Behaviors Questionnaire (SBQ; Addis & Linehan, 1998) or based on responses to multiple instruments (i.e., suicide risk as a multivariate phenomenon; Lanza, Patrick, & Maggs, 2010), and to further model likelihood of individuals transitioning between classes (or levels) of suicide risk over time. Incorporating moderation analysis into the LTA allows for assessing whether covariates, such as depression or anxiety symptomatology, non-suicidal self-injury or history of prior suicide attempts, or intervention effects, predict the likelihood of transitioning between suicide risk classes. Additionally, we model the role of the study's intervention mechanisms, including distress tolerance and mindfulness, in predicting suicide risk class membership. The anticipated benefit of this analysis approach is that it is a step in evidencing, using data collected through suicidality, depression, and anxiety instruments in wide use in college settings, distinct suicide risk trajectories moderated by mental health concerns prevalent among college students, such as depression and anxiety. Further, this approach establishes a framework for examining the role of other common risk factors for suicide, including eating disorder symptomatology and substance abuse, as well as intervention effects, in moderating change in suicide risk over time.

**Paper Session 3.2**

**Saturday, September 29, 10:30am-12:15pm, Continental Divide**

**Modern Methods for the Treatment of Missing Data in Longitudinal Research**

*Todd Little*

I will discuss recent advances in treating missing data in terms of both planned and unplanned missing data. Unplanned missingness due to nonresponse and attrition can be readily addressed when forethought guides the design of the research protocol. In addition, planned missing data can have advantages over complete protocol approaches. I will present newly developed methods for treating both forms of missing data as well as offer some directions for further development in the missing data arena.

**Bias Correction for Replacement Samples in Longitudinal Research**

*Jessica A. M. Mazen & Xin Tong*

Missing data is a commonly encountered problem in longitudinal research. One way researchers handle missing data is through the use of supplemental samples (e.g., Fong et al., 2006). A supplemental sample is a set of new participants added to the original sample after missing data appear at the second or later measurement occasions in order to reduce the detrimental effects of unplanned missingness. There are two approaches researchers can take when selecting a supplemental sample: a refreshment approach or a replacement approach. Using a refreshment approach, researchers select additional participants using the same criteria as the initial participants (i.e., random selection from population of interest). In this case, regardless of the type of missing data pattern (e.g., MCAR vs. MAR), researchers follow the initial study design utilizing the original sampling frame and procedures to recruit new participants. In contrast, using a
replacement approach, researchers first identify auxiliary variables that explain the pattern of missingness in the data and then select new participants based on those attributes. Thus, researchers are attempting to replace participants from the original sample lost to attrition by over-selecting participants with the same characteristics for the supplemental sample.

Past research demonstrates that refreshment samples are a viable solution to handling missing data in longitudinal studies (Mazen, Tong, & Taylor, 2018; Taylor, Tong, & Maxwell, 2018). The use of refreshment samples results in low levels of bias similar to that for the complete data. Further, adding refreshment samples results in increased efficiency and power, and these benefits increase as the size of the refreshment sample increase. However, using replacement samples leads to biased estimates, and this bias grows as both the size of the replacement sample and the missing rate increase (Mazen et al., 2018; Taylor et al., 2018).

Despite the fact that replacement samples have been used in existing longitudinal studies and caused bias, there are no studies addressing how to correct this bias. Thus, for this study, we propose three ways to correct the bias introduced by replacement samples with goal of not only correcting the bias, but also preserving the benefits of using supplemental samples (e.g., increased power and efficiency). Our results show that the proposed methods can eliminate the bias associated with replacement samples and provide increased power and efficiency compared to the original data.

In this talk we will introduce, evaluate, and compare the performance of three bias correction methods: a sample reweighting method, a parametric bootstrapping method, and a non-parametric bootstrapping method. We will also provide guidance for researchers considering using supplemental samples and for researchers who have already utilized a replacement approach.

**Advancing Multiple Imputation for Latent Profile Analysis**

*Marcus R. Waldman*

The treatment of missing data is problematic when conducting latent profile analysis (LPA) in the presence of indicator data that is missing at random, conditional on auxiliary variables. This is true even if the researcher adopts “state of the art” (Schafer & Graham, 2002) strategies, such as full information maximum likelihood (FIML) or multiple imputation (MI). In fact, because these models lack the indicator disturbance terms found in factor models, FIML’s ability to incorporate auxiliary variables is limited by the inability to directly translate the special parameterizations introduced by Graham (2003) for factor analysis into LPA. Thus, although FIML is a highly popular missing data strategy for LPA and is implemented by default in some software, the method’s utility is limited by its inflexibility to accommodate auxiliary variables as they appear in the real world.

In contrast, MI methods are generally more flexible in accommodating auxiliary variables when, for example, a chained equations procedure is applied. However, multiple imputation is currently not recommended when conducting LPA because the imputation models make parametric assumptions that assume that the population is comprised of only a single class (Enders & Gottschall, 2011). As I will demonstrate in my presentation, this results in plausible values that are not “proper” (Schafer, 1997), which is the root cause for why otherwise distinct subpopulations become obfuscated during enumeration (Sterba, 2016).

Complicating matters further, it remains unknown how best to pool information criteria (IC) when conducting model selection during enumeration, even if proper imputations could somehow be generated. The practice *averaging* ICs across the imputed data sets is widespread. However, there is no theoretical basis for *averaging*, and it remains unknown whether *averaging* is superior to alternative pooling procedures.
Taken together, these challenges imply that the application of MI in LPA remains highly limited by unresolved methodological gaps in both the imputation phase and in the pooling phase. The goal of this study is to address these shortcomings. To accomplish this goal, I will conduct a simulation study by generating data under a variety of conditions and employ a missing at random missing data mechanism.

Regarding the imputation phase, I will evaluate whether nonparametric imputation models are superior to popular alternatives for generating proper imputations. Specifically, I will evaluate the performance of a variety of nonparametric methods (e.g., predictive mean matching, classification and regression trees, and random forests) compared to more common parametric approaches like multivariate normal imputation.

Regarding pooling for enumeration, several alternatives to averaging exist for pooling information criteria across imputed data sets, and preliminary results suggest that averaging produces negatively biased IC estimates and disparate rates of correct model selection when proper imputations are generated. Alternative pooling strategies include majority vote, which selects the model that minimizes the IC most frequently across the imputed data sets, stacking, in which the researcher appends and reweights the data to form a single analytic data, and a procedure that leverages a pooled $D$ statistic (Consentino & Claeskens, 2010).
Waves of Change: How Many Waves of Assessment are needed to Effectively Disaggregate Autoregressive and Growth Curve Processes?

D. Angus Clark, Amy K. Nuttall, & Ryan P. Bowles

The autoregressive and growth curve modeling traditions each provide useful, but distinct, insights into developmental trends. Accordingly, more recent modeling frameworks have attempted to synthesize these traditions. However, recent evidence suggests that statistically separating autoregressive and growth curve processes may be difficult unless there are many waves of assessment (Clark, Nuttall, & Bowles, 2018). Further, the less separable these processes are, the greater the likelihood of obtaining substantially biased parameter estimates; and these models with biased parameter estimates may even fit the data well. In this study the association between autoregressive and growth curve process multicollinearity, and the number of time points in a model, was systematically investigated using Monte Carlo simulation methods. Misspecification, parameter bias, and model fit were also considered. These issues were examined in three models: the latent change score model (LCS; McArdle & Hamagami, 2001), the autoregressive latent trajectory model (ALT; Bollen & Curran, 2004), and the latent curve model with structured residuals (LCM-SR; Curran et al., 2014). The number of time points (from 5 to 20), and the degree of misspecification (represented by incorrectly imposing invariance on the autoregressive paths over time), were varied across conditions. In the LCS, the correlation between the autoregressive coefficient and slope factor mean estimates across replications fell from $r = -0.99$ (5 waves) to $r = -0.12$ (20 waves) in correctly specified models. Alternatively, these correlations were consistently large in ALT models ($r_s$ of -0.99), and consistently small in LCM-SR ($r_s$ from .04 to .01). Results also indicated that less process multicollinearity was associated with much less bias in parameter estimates when there was misspecification, though these solutions fit poorly. Overall, results demonstrate the importance of statistically separating autoregressive and growth curve processes in the same model, while highlighting the conditions under which this is facilitated.

Sensitivity Analysis for Mediation Effect in Longitudinal Designs

Qinyun Lin, Amy K. Nuttall, & Kenneth A. Frank

Mediation is of interest for studying intervention outcomes. Longitudinal designs provide less biased estimates than cross-sectional or sequential designs (Cole & Maxwell, 2003; Maxwell & Cole, 2007; Maxwell, Cole & Mitchell, 2011; Mitchell & Maxwell, 2013). Yet there may be confounders invalidating effects. We extend approaches proposed by Frank (2000) and Frank et al. (2013) for linear models to quantify the robustness of mediation effects in longitudinal designs. We study full and partial mediation effects from two autoregressive models presented by Maxwell and colleagues. We propose two general frameworks: 1) consideration of potential unobserved factors that affect either the treatment $X$ and the mediator $M$ or the mediator $M$ and the outcome $Y$. We apply the index Impact Threshold of a Confounding Variable (ITCV)(Frank, 2000) which quantifies how strong a possible confounder needs to correlate with both the outcome and the predictor of interest to invalidate an inference; 2) consideration of unobserved latent mediators. Omitting latent mediators can lead to biased estimates of the indirect effect. Here, we extend the sample replacement idea from Frank et al. (2013) to characterize the robustness of the inference about an indirect effect in terms of the number of cases that would have to be mediated by unobserved latent mediators to invalidate an inference of a causal mediation effect. This leads to statement such as “25% of the cases would have to be mediated by an
unobserved latent factor instead of the observed mediator M to invalidate the inference that M mediates the effect of X on Y.” Simulation results are also presented to illustrate these approaches. We contextualize our approaches by considering existing ways to conduct sensitivity analyses in mediation, including the residual correlation (Imai et al., 2010), the impossible mediation test (Yeager & Krosnick, 2017) and the weighting method (Hong, 2010).

**Marital Conflict and Its Microlevel Processes: Applications of the Experience Sampling Method**

*Mengyu Gao & E. Mark Cummings*

Understanding marital conflict and its processes has significant implications for promoting family functioning, given its established associations with multiple aspects of family life, such as parent-child relationship and sibling relationship (e.g., Krishnakumar & Buehler, 2000). Existing research, however, typically employed a static and macro-level perspective to assess and study marital conflict (e.g., in-laboratory behavioral observation, self-report questionnaires), yet rarely captured its interactive, fast-changing, and micro-level characteristics. Therefore, the current study applies an experience sampling method and investigates 1) whether the negativity one person experiences in one conflict is associated with the negativity in the next conflict, 2) whether such conflict carryover effects differ for husbands and wives, and 3) the conditions under which such carryover effects may vary. Data were drawn from 111 married couples’ diary reports of marital conflict over 15 days and were analyzed with dyadic multilevel models. Both husbands and wives reported their negative emotions and behaviors, as well as how much they contributed to the solution at the end of each conflict. Global marital satisfaction was also reported. Results showed that the carryover effects were only significant for wives but not for husbands: compared to males, females were more likely to continue reflecting on a previous conflict thus bring the negativity to the next conflict. Regarding partner’s influence on each other, only the influence of husbands’ negativity on wives’ negativity was found. In addition, wives’ carryover effects were found to vary as a function of marital satisfaction and their contribution to the solution of a conflict. That is, the carryover effects of conflict negativity were larger for wives who reported lower levels of marital satisfaction or contributed less to the solution of the current conflict. Implications of experience sampling method and challenges of analyzing intensive longitudinal data in family research will be discussed.

**Does Empathy Have a Cost? Older Adults’ Encounters with Social Partners Incurring Problems and Mood throughout the Day**

*Meng Huo, Jamie L. Graham, & Karen L. Fingerman*

Older adults are commonly exposed to their social partners’ life problems. Yet, such exposure may vary by older adults’ empathy. Indeed, more empathic older adults may be more aware of their social partners’ problems than their less empathic counterparts. Social partners with problems also may prefer to disclose these problems to more empathic older adults than less empathic older adults. It remains unclear, however, whether more empathic older adults: (a) interact with social partners who have problems more often, (b) discuss stressful information with these partners more often, and (c) incur a greater cost on their mood due to the distress they share during these encounters. To examine these questions, we drew on the Daily Experiences and Well-being Study (DEWS, 2016–2017) that included 313 older adults aged 65 and over who reported on their own characteristics (e.g., age, gender, education, empathy) and specified the life problems that each of their social partners had. We then utilized Ecological Momentary Assessments (EMA) to capture these older adults’ social encounters with each partner and their mood every 3 hours each day across 5 to 6 days. As expected, we found that more empathic older adults reported having more social partners incurring life problems than did less empathic older adults. Yet, on a momentary basis, multilevel regressions showed that empathy did not increase the likelihood for older adults to have encounters with social partners incurring problems or to discuss anything stressful during these encounters. Moreover, when they did discuss stressful things with social partners incurring problems, more empathic older adults experienced a flatter decline in their positive mood than their less empathic counterparts throughout the day. This study reveals a buffering effect of older adults’ empathy in the face of stress, suggesting the central role of empathy in successful aging.
Variable-centered and Person-centered Approaches for Psychometric Investigation of Measurement Invariance

Hyanghee Lee

The present study shows the application of combining the measurement invariance framework with person-centered analyses in cross-cultural studies. This study deals with the measurement of the revised Martial Comparison Level Index (MCLI, Sabatelli, 1984; Lee; 2018) for Koreans and Americans.

Using the sample of Korean and American married individuals (N=676), measurement invariance testing in the variable-centered approach was conducted to assess whether the measure performs in the same way across two cultures. Results showed that there was a second-order factor, which is marital quality, that underlies the five first-order factors (i.e., emotional intimacy, sexual intimacy, marital conflicts, intergenerational relationships, and complaints about partner’s lifestyle). The identified second-order factor structure showed an adequate level of measurement invariance, indicating the potential for explaining cross-cultural relevance of the marital construct.

Upon establishing the adequate level of measurement invariance, Latent Profile Analysis (LPA) was used to investigate profile similarity across groups, which indicated the extent to which generalizability of profile solution deserves further exploration (Morin, Meyer, Creusier, & Biety, 2016). The results showed that the three-profile solution was retained for both samples, supporting the configural similarity of the model across Korea and the U.S. However, the nature of the profiles was different across groups. Given that the adequate level of invariance was established in the variable-centered analysis, structural differences may reflect true differences in the nature of the profile themselves. That is, there are cultural differences in terms of the ways in which the each construct of marital quality combines.

Because of the differences of the within-profile characteristics (i.e., means and variances) and relative sizes of all profiles across cultures, predictors and outcomes were added to the separate LPA models for the Korean and American sample to explore the relations between profiles and predictors/outcomes. A major objective of including key covariates was to investigate likely determinants and consequences of profile membership, which demonstrates construct validity by showing meaningful relations to predictors, correlates, and outcomes (Kam et al., 2016; Morin et al., 2016; Muthén, 2003).

The predictors included in the following analysis were demographic characteristics (i.e., gender, relationship duration, and being a parent). In the Korean sample, as relationship duration increased, the likelihood of membership in Profile 1 (High-quality Marriages) was reduced. Also, being male predicted an increased likelihood of membership into Profile 1 (High-quality Marriages) relative to Profile 3 (Low-quality Marriages). Similarly, being male predicted an increased likelihood of membership into Profile 1 (Stable and High-quality Marriages) relative to Profile 3 (Low-quality Marriages) in the American sample. Being a parent had little implication for profile membership across cultures.

Next, distal outcomes (relationship satisfaction and stability) were added to the LPA models. Levels of relationship satisfaction were significantly greater in Profile 1 (High-quality Marriages) in the Korean sample, supporting the positive relations between MCLI scores and relationship satisfaction across profiles. Similarly, the assessment of outcomes relative to expectations was positively associated with relationship satisfaction in the American sample. Relationship stability was also related to the scores on MCLI, suggesting the positive relations between high-quality marriages and relationship stability regardless of cultural differences.

Taken together, the present study provides an example of hybrid variable- and person-centered approaches that may be helpful for psychometrics investigations of measurement invariance.
Applying a Mixture Modeling Approach to Parentification Theory: Family Profiles and Child Adjustment Trajectories

Amy K. Nuttall, Kristin Valentino, E. Mark Cummings, & Patrick T. Davies

There is a gap between theory and methods for assessing parentification. Parentification theory emphasizes contextualizing children’s caregiving roles within the family system and within children’s adjustment in order to define parentification (Jurkovic, 1997). However, much of the extant literature examines children’s caregiving roles without contextualizing these roles (Nuttall & Valentino, 2017). The present study (N=235) applied finite mixture modeling (McLachlan & Peel, 2000) with kindergarten children’s caregiving and contextual variables of parenting as well as children’s concurrent and prospective adjustment over two years. We used a model building approach to consider operationalizations of parentification. First, we reported frequency of children’s caregiving without contextualizing caregiving (88%). Second, we contextualized caregiving at the family level using latent class analysis (LCA) in Mplus to identify a parentification class (30%) characterized by elevated children’s caregiving accompanied by perceptions of poor parental competence to provide caregiving, and poor parental autonomy support) that qualitatively differed from the non-parentification class. Third, we further contextualized children’s caregiving by children’s adjustment. We incorporated the LCA solution into three separate growth mixture models (GMM) with children’s adjustment over time across three domains (internalizing, externalizing, prosocial behaviors). We identified parentification classes (elevated child caregiving embedded in a context characterized by perceptions of poor parental competence to provide caregiving, poor parental autonomy support, and increased externalizing or internalizing symptoms, or decreased prosocial behaviors over time in comparison to non-parentification classes) constituting a larger proportion of the sample (44 - 54%) than considering parenting context alone (30%) but less than caregiving behaviors in isolation (88%). Final class solutions were selected based on BIC (Schwartz, 1978) as suggested by Nylund, Asparouhov, and Muthen (2007). Together these findings emphasize the importance of contextualizing children’s caregiving roles at both the family and individual level in defining parentification and caution against overpathologization of children’s caregiving roles.

Latent Profile Analysis of Risk Groups of Special Education Teacher Attrition

Soyoung Park

This study aims to identify the characteristics of dissatisfied teachers of students with special needs by using predictive factors of special education teacher attrition. By understanding the underlying factors that contribute to teachers’ dissatisfaction, educational policy makers can take actions to reduce special education teacher attrition (Darling-Hammond, 2000). The Teaching and Learning International Survey (TALIS, 2013), one of the largest international surveys on educational environment, was used to captures international perspectives from 33 countries. The analytic sample in this study consisted of 1,370 teachers from 33 countries (OECD, 2014). Latent profile analysis (LPA) was employed to derive latent classes that describe different categorical types of participants based on the response pattern associated with continuously measured observed variables in the data set (Nylund, Asparouhov, & Muthén, 2007). As a result, four latent groups were identified. The classified latent groups were named as “teacher-student relations needs”, “effective professional development needs”, “classroom disciplinary climate needs”, and “efficacy in classroom management needs”. This study provides in-depth information on the global trends of teachers’ dissatisfaction and related factors. Implications, limitations, and future research were discussed.

Comparison of Newly Introduced Weight Trajectories to Structural Equation Modeling to Explore Children’s Weight Longitudinally

Julie M. Rutledge, Taren Swindle, Amanda W. Harrist, Laura Hubbs-Tait, Glade L. Topham, Robert E. Larzelere, & Lenka H. Shriver

Background: This study introduces weight trajectories as an alternative to SEM analyses of children’s Body Mass Index-% weight longitudinally. Weight Trajectories focus analyses on children moving in and out of obesity risk and comparing children who stay in the healthiest weight range to those who stay at higher ranges.
Methods: Five Weight Status groups and nine Weight Trajectories were defined using BMI-%. Stable-Low-Healthy-Weight, Stable-Low-At-Risk, and Stable-High-At-Risk relate to staying in the same Weight Status (4-49.9, 75.84.9, and 85-94.9 BMI-%) across waves or in wave 1 and 3. For SEM, Weight Status is analyzed as a continuous variable (Range = 1-5). Participants included 356 mother-child pairs with a measure of parenting style for wave 1 (1st grade) and BMI-for-Age-% for three waves.

Results: Multinomial logistic regressions was used to examine differences among Weight Trajectories as predicted by parenting style with reference category being Stable-Low-Healthy-Weight. Permissive Parenting significantly predicted group differences, \( \chi^2(8) = 21.87, p = .005 \) and differentiated Stable-Low-At-Risk-Weight [Wald \( \chi^2(1) = 7.60, p = .006 \)] and Stable-High-At-Risk-Weight [Wald \( \chi^2(1) = 4.14, p = .04 \)] from Stable-Low-Healthy-Weight. For each increase of 1 in Permissive Parenting score, children were 3.5 times more likely to be Stable-Low-At-Risk-Weight and more than twice as likely to be Stable-High-At-Risk-Weight than Stable-Low-Healthy-Weight.

A quadratic growth model (SEM) examined changes among Weight Statuses across three waves. The model was just identified, thus, the model fit the data exactly, \( \chi^2(0) = 0.00, CFI=1.00, RMSEA<.001 \). Authoritarian and Permissive Parenting were significant predictors of Weight Status. Authoritarian Parenting did not predict initial differences (intercept, \( b = -.09, p = .30 \)) but did predict changes across time (slope, \( b = .19, p = .02 \); quadratic, \( b = -.11, p = .02 \)). Permissive Parenting predicted initial differences (intercept, \( b = .19, p = .02 \)) but not changes across time (slope, \( b = -.13, p = .08 \); quadratic, \( b = .06, p = .15 \)).

Conclusion: SEM analyses showed Authoritarian Parenting but not Permissive Parenting predicted longitudinal changes. Weight Trajectory analyses clarified that Permissive Parenting significantly predicted longitudinal stability in that stable at-risk (low and high) trajectories across three waves differed significantly from the stable healthy weight trajectory.

**Differential Covariate Association between Construct Operationalizations**

Yusuke Shono, Alan W. Stacy, & Brian P. Flaherty

Latent class (LC) and item response theory (IRT) models represent two widely used classes of latent variable (LV) measurement models for examining the latent structure of latent variable (LV) with LC model characterizing LV as categorical and IRT characterizing LV as continuous. Within the LC models, unrestricted LC (U-LC) models have been used almost exclusively for construct operationalization in applied research though restricted LC (R-LC) models (e.g., Lazarsfeld & Henry, 1968) have been around for a long time and may also be used. The present study compared three LV models—IRT, U-LC, and R-LC (specifically, the intrusion-omission model; Dayton & Macready, 1976)—to examine different conceptualizations of the latent structure of adolescent polydrug use and differential associations of the latent polydrug use with the covariate drug-related memory associations. Results showed that each LV model uniquely characterized the latent polydrug use. IRT placed each drug item on a latent continuum according to drug severity levels with alcohol, marijuana, and cigarettes being among those with lower severity levels. U-LC identified four different classes whereas R-LC, based on a priori model specification, classified six classes. Most notably, IRT and U-LC analyses revealed strikingly similar associative patterns of the latent polydrug use with memory associations in that memory associations regardless of drug types were associated with severity of drug use patterns. In contrast, in the R-LC analyses drug-specific memory associations distinguished classes characterized by the relevant drug type, thus providing more theoretically compelling findings. For example, marijuana-related memory associations distinguished between the “no-use” and “alcohol-marijuana” classes but did not distinguish the “alcohol-only” class from the “no-use” class. This study highlights the value and utility of the R-LC models in construct operationalizations, particularly when the construct of interest is also examined for its cross-sectional and/or longitudinal association with other constructs (e.g., evaluations of criterion-related validity).
Optimizing the Power of Positive Relationships: Which Preschool Teachers Benefit Most from Professional Development Coaching?

Crystal Lederhos Smith, Gitanjali Shrestha, Eleanor Dizon, Ben Bayly, Senait Tekle, & Brittany Rhoades Cooper

Research has demonstrated links between positive teacher-child interactions and child outcomes, as well as between professional development and child outcomes.

The National Center for Research on Early Childhood Education (NCRECE) Teacher Professional Development Study conducted a randomized control trial of a professional development intervention aimed at increasing quality teacher-child interactions. Results indicated a positive effect of the MyTeachingPartner intervention.

Our approach was guided by Self Determination Theory (SDT), a widely-used theory of human motivation, which highlights the importance of three basic needs (autonomy, competence, and relatedness) that help individuals reach their goals. Our analysis plan consisted of two steps: 1) utilize latent class analysis (LCA) to identify unique subgroups of teachers based on the three basic needs from SDT; 2) determine whether the effectiveness of the consultancy intervention on teacher-child interactions varied by subgroup.

Based on fit criteria (e.g. AIC, BIC), interpretability of classes, and parsimony, we selected a 3-class model: a confident and supported (32%; all basic needs met), a uncomfortable but supported (30%; autonomy and relatedness support), and an unconfident and unsupported subgroup (37%; only some autonomy support). We then used the approach suggested by Bolck, Croon, and Hagenaar (2004; BCH) which uses posterior probabilities to weight the likelihood of membership in each latent class. We conducted weighted regression analyses testing the effect of the intervention, latent class, and the interaction between the intervention and latent class.

Results revealed that the intervention was most beneficial for teachers from the confident and supported subgroup (those who had all 3 of their basic needs fulfilled). Our findings suggest it may be appropriate to create a tiered approach to the intervention, first targeting teachers’ basic needs, then targeting professional development.

How Best to Assess the Dynamic System of Preparation for Bias Socialization as a Moderator?

Kimberly Osborne & Margaret Caughy

Preparation for bias is a socialization strategy used by ethnic minority parents to prepare children for experiences of discrimination. Despite a recent increase in research on this topic, the specific effects of these messages on child outcomes remain unclear (see Hughes, 2006 for review). Furthermore, the transition of children into mainstream education may represent a developmental stage where both the heightened perceived relevance of these messages to parents, and the comprehension of these messages by children, coincide (Caughy, O’Campo, Randolph, & Nickerson, 2002; Hughes, 2006; Nesdale, Durkin, Maass, & Griffiths, 2005). The current study assessed the moderating effect of preparation for bias on the relation between parents’ experiences with racism at one time point and child internalizing behaviors at a second time point in a sample of African American and Latinx first graders (N = 332). Using structural equation modeling, a product term was created representing the interaction between preparation for bias sum scores and a higher order construct of racism experiences, and was found to be significant (b = .45, p < .05). For parents who reported low experiences of racism (both frequency of experiences in the past year and stress appraisal of these experiences) and used low preparation for bias messages, children had similar internalizing scores to those parents who reported high on both constructs. These findings are consistent with previous research indicating a curvilinear relation between parents’ racism experiences and children’s internalizing problems (Caughy, O’Campo, & Mutaner, 2004).

Preparation for bias is a dynamic socialization strategy that parents adapt to the age of the child and to the context of their own experiences. A methodological question remains regarding how best to assess this dynamic system and its moderating role on child internalizing outcomes as children are developing in a racialized society?
How Do We Handle Multi-wave Varying Measures of Physical Activity with Uneven Time Intervals between Waves?

Julia C. Tang

The National Longitudinal Study of Adolescent to Adult Health (Add Health) offers rich, diverse longitudinal data that is nationally representative. However certain measures have been inconsistently measured across waves. Variance in measurement across waves are sometimes developmentally based and due to changing appropriateness of measurement by age and developmental period. Other changes include dropping or adding behaviors as well as shifts in wording or splitting/merging of behaviors across questions. This issue is particularly prevalent with regard to physical activity. An overview of questions flagged by the Add Health Codebook Explorer related to physical activity/inactivity identify multiple questions. However none of the questions related to exercise of physical activity are measured consistently across all four waves.

As health problems emerge earlier, there is an increasing need for researchers to look beyond health-risk behaviors and to consider behaviors that promote health. Today's adolescents and young adults engage in less physical activity, and more sedentary behavior across the transition to adulthood (TTA; Caspersen, Powell, & Christenson, 1985; Gordon-Larsen, Nelson, & Popkin, 2004; Nelson, Gordon-Larsen, Adair, & Popkin, 2005; Pate, Heath, Dowda, & Trost, 1996).

The life-course perspective suggests the need to study early life experiences and factors that may relate to stability or change in healthy behaviors across the transition to adulthood. Congruent with the principle of lifespan development, researchers have found examples of continuity in healthy behaviors, such that earlier healthy behaviors, like physical activity participation, predict later healthy behaviors (Telama et al., 2005) and such continuities suggest the presence of cumulative effects or stability of healthy behaviors across time (Li, Cardinal, & Settersten, 2009).

Methodologically, however, the study of behaviors inconsistently measured, like physical activity, presents a challenge. This poster seeks feedback to the question regarding how best to handle varying measured physical activity, uneven time intervals, and longitudinal and developmental methods that can be appropriately applied to examine interindividual and intra-individual changes in physical activity and the covariates associated with variability across individuals in physical activity trajectories.
Bayesian Measurement Invariance: The Investigation of Measurement Invariance using Bayes Factor and ROPE

R. Jiang & P. Rast

Measurement invariance (MI) is a key to psychological assessment across groups or different time points (Millsap & Meredith, 2007). The establishment of MI ensures the comparability of factor scores so that the observed difference or change can be appropriately evaluated and interpreted (French & Finch, 2008). The majority of methods used for assessing MI base on multigroup SEM comparison via a series of $\chi^2$ difference tests. MI is achieved by non-significant $\chi^2$ between two nested models (i.e., more restricted model doesn’t fit significantly worse than the less restricted one). This approach leaves several issues unaddressed: First, the rejection or acceptance of the null hypothesis doesn’t provide any supportive evidence for the invariance or non-invariance (Verhagen et al., 2016; Yuan & Chan, 2016). Second, fitting a series of progressively more restricted models potentially inflate the Type II error (French & Finch, 2008). Further, when full MI is untenable, using the modification indices to detect the non-invariance and fitting a partial invariant model can be cumbersome.

We present an alternative approach based on Bayesian model comparison (Kruchke, 2011), using Bayes factors and the region of practical equivalence (ROPE) to detect non-invariance. The ROPE and Bayes factor can be obtained from Bayesian SEM (BSEM; Muthen & Asparouhov, 2012). The ROPE defines a region that is deemed to be equivalent in terms of posterior density for the parameters of interest and the Bayes Factor provides hypothesis test with respect to equivalence and difference for these same parameters. We present results from a simulation study using BSEM. For the simulation conditions, the manipulated factors included sample size, source and magnitude of non-invariance, and factor structure. The results showed that 1) supportive evidence for MI could be gathered from a Bayes factor between two models, 2) all non-invariant parameters could be detected simultaneously using the ROPE.

Exploring Mediation from a Person-Oriented Perspective

Heather L. Smyth & David P. MacKinnon

Developmental processes are complex interactions of biological, psychological, and situational factors (Bergman & Magnusson, 1997). Person-oriented approaches to developmental research focus on individual patterns of responses across relevant variables, providing information beyond what may be available in traditional variable-oriented analyses. Mediation can be conceptualized as a person-oriented process, in which each person may have a pattern reflecting different exposure to a predictor, change through a mediator, that affects an outcome (Bergman, 2009; Collins, Graham, & Flaherty, 1998; von Eye, Mair, & Mun, 2010). A mediation method that focuses on patterns of variables may be more consistent with individual-differences theory than standard, variable-oriented mediation, and provide more and complementary information about individual development.

The purpose of this poster is to describe mediation analysis with a person-oriented approach, using configural frequency analysis (von Eye, Mun & Mair, 2009) and to report results of a simulation study comparing configural frequency mediation analysis with variable-oriented mediation methods from logistic regression and causal mediation. The results focus on the basic case of mediation when the predictor, mediator and outcome are all binary variables defining eight possible patterns: a person can either have or not have the predictor, either have or not have the mediator, and either have or not have the outcome. The statistical performance of these three methods were evaluated with two data generating models, the first corresponding to a variable-oriented single mediator model, and the second corresponding to a heterogeneous population with groups of observations that have either full, partial, or no mediation. Methods were compared for Type I error rates, power, and parameter bias at varying levels of effect and sample size. Implications of the results for mediation analysis of persons versus variables are discussed.
**Dynamic Structural Equation Models (DSEM) for Lifestyle Factors Associated with Cognitive Performance**

*Kathleen S. Caffrey, Jonathan Preszler, G. Leonard Burns, Bruce R. Wright, & Maureen Schmitter-Edgecombe*

Several lifestyle factors (e.g., physical and mental health, fatigue, physical and mental activity) have demonstrated associations with cognitive performance, and equivocal evidence exists in terms of the influence of these factors on perceived cognitive functioning. However, limitations of cross-sectional and traditional longitudinal research designs impede our ability to answer more complex questions about these relationships, including whether lifestyle factors are predictive of changes in cognitive performance at the within-person level. Thus, the current study used intensive longitudinal data and multivariate time series analysis to determine whether lifestyle factors are predictive of subsequent cognitive performance (perceived and actual) over time and examine the within-person dynamics of these relationships. Responses to brief survey questions assessing lifestyle factors and scores on a brief n-back test were gathered from 34 participants at four separate occasions per day for one week. We applied Dynamic Structural Equation Modeling by specifying multilevel vector autoregressive models, which specify a time series model at the within-person level and allow for individual differences at the between-person level. Fatigue and physical activity significantly predicted the n-back test performance at the within-level, suggesting that fatigue and physical activity had an effect on shape test performance over time on average in our sample. Fatigue, emotional difficulties, and mental engagement were significantly associated with perceived cognitive functioning at the between-level, suggesting that an individual in our sample who reported lower perceived cognitive functioning on average was more likely to report higher levels of fatigue and emotional difficulties and lower levels of mental engagement. Our results further elucidate the nature of the relationships among lifestyle factors and cognitive performance and have important implications for future research and cognitive health intervention. In addition, the observation of distinct effects at the within-level and the between-level highlights the utility of modeling these effects simultaneously.

**Measuring Discrimination: Construct Validation of an Abbreviated Version of the Everyday Discrimination Scale**

*Shanting Chen & Aprile Benner*

A wide range of measures assess discrimination, but the 9-item Everyday Discrimination Scale (EDS; Williams, Yu, Jackson & Anderson, 1997) is the mostly widely used in the field. However, this multiple-item measure may not be feasible in large-scale surveys where the number of questions that can be administrated are limited due to time and space constraints. In these cases, shortened EDS measure would be advantageous. Indeed, the national Add Health survey combined the first two EDS items (i.e., treated with less respect, treated with less courtesy) into a single-item measure. However, whether this measure yields equivalent psychometric properties as the EDS is unknown. Thus, this study examines whether the two-item measure (consistent with Add Health) and the 9-item measure, correlations of the two EDS measures with 10 different psychological and physical health outcomes were tested. Results suggested that the two measures showed highly similar correlations with the outcome measures (the differences of the correlations ranged from .00 to .008). The two measures were also highly correlated with each other ($r = .83$). These preliminary findings supported the reliability and validity of the 2-item measure and suggest that it can provide a practical alternative to EDS. Future research will examine convergent validity across races, genders, and ages.
Relationship Commitment: Variability and Continuity in Married Couples

Hyanghee Lee

The purpose of the present study is to identify unobserved sub-groups of couples that exhibit differential patterns of relationship commitment over eight years in a sample of continuously partnered couples in the German Panel Analysis of Intimate Relationships and Family Dynamics (Pairfam; http://www.pairfam.de/en/). This study highlights the importance of studying the variability of relationship commitment in intact relationships. To investigate changes in relationship commitment with multi-wave longitudinal data, I used growth mixture modeling to describe longitudinal changes in commitment within each unobserved sub-population. Next, I proceeded to explore the relative contribution of social exchange variables in influencing membership in different commitment trajectories. The following key social exchange variables were used for this analysis: relationship rewards (e.g., sexual satisfaction, need fulfillment), equity (e.g., the fairness of housework contribution), and barriers (relationship length, number of children, and employment status).

Considering that our 734 couples sample may have been drawn from at least two sub-populations of couples (high and less committed couples), I fit the series of models with one, two, and three classes. However, when moving from the two unobserved groups to three unobserved groups, no one was classified into one of the unobserved groups in the 3-ClassMeans model. Thus, I concluded, based on all the information about the models, the 2-ClassMeans model was the most appropriate for the data.

On average, Class 1 contained most of the sample, n=661 couples (90%), who were assigned to this latent class with .96 probability. The average trajectory of this class started out at 4.19 and 4.32 for female and male partners, respectively. They didn't show much change over the 8 years of the study. All together, the parameter estimates for class 1 appeared to be a “highly committed couples” group.

On the other hand, Class 2 contained 73 couples (9%) who were, on average, assigned to this second latent class with .85 probability. This latent class was allowed to differ from the first class regarding the mean of the intercept and slope variables. The average trajectory of Class 2 began at 3.79 and 3.59 for female and male partners, respectively. They showed a significant decrease in their relationship commitment over the 8 years of the study. Taken together, the parameter estimates for class 2 appeared to describe a “less committed couples” group.

Next, the impacts of social exchange variables on the relationship commitment class membership were tested using logistic regression with class membership as the dependent variable and relationship rewards, equity, barriers as predictor variables. The predictors were entered into one logistic regression predicting relationship commitment class membership at Wave 1, 3, 5, and 7 for a total of four separate models. In the logistic regressions, marital rewards (need fulfillment) were associated with a decrease in the odds of being in a less committed relationship only among male partners at each Wave. In addition, employment status at each wave was associated with commitment class membership. For example, stay-at-home dads were more likely to be a member of the highly committed couples class across all waves, compared to male partners working full-time. Lastly, Female partners who reported receiving more benefits from their relationship may consider themselves more dependent, which in turn, showed more commitment to their relationship.

A detailed examination of unobserved the relationship commitment trajectories and identifying factors that have a deleterious impact on commitment over time could be an important step in the understanding of what goes on inside of an intimate relationship over the course of a marriage.
Use of Latent Profile Analysis to Examine Discrepancies in Multi-Method Parenting Measures

Sun-Kyung Lee, Kadie Ausherbauer, Timothy Piehler, Abigail Gewirtz, & Gerald August

Multi-method measurement of parenting often shared less variance than would be expected. It is unclear if common patterns of discrepancies across measures are present among parents and, if present, if those patterns are related to other aspects of parent functioning. This study sought to identify common profiles of parents across a range of observed and self-reported parenting measures and to evaluate if those profiles may be related to parental depression, anxiety or social support. 134 families were included in this study with 213 children between ages 6-12 years (range 1-5 children per family). Parents’ self-reported parenting (SR) was measured by the Parenting Relationship Questionnaire (7-sub scales). Observed parenting practices (Obs) were coded in a structured Family Interaction Task (5-domains). Predictors such as parent depression and anxiety were measured by Brief Symptom Inventory, and parent social support was measured by Interpersonal Support and Evaluation List.

The correlation between self-report and observed parenting indicators ranged between .164 and .467. LPA models using 12 indicators were analyzed accounting for the multilevel nature of the data. Using chi-square, AIC, BIC, saBIC, LMR-LRT, saBIC, and interpretability, a 4-class solution was selected as optimal. Entropy was .786. Predictors (parent depression, anxiety, and social-support) of class membership were estimated using the manual 3-step process, incorporating class-specific classification error in the latent class variable. Several demographic covariates were also included.

Four meaningful classes emerged: HighSR-HighObs, LowSR-LowObs, HighSR-LowObs, and LowSR-HighObs. With HighSR-HighObs class as a reference group, Low-Low and LowSR-HighObs group reported significantly lower social support (Log Odds= 0.149, p=.008; Log Odds=0.168, p=.009, respectively). The difference observed between the HighSR-HighObs and LowSR-HighObs groups may indicate that a lack of perceived social support negatively affects self-reported parenting but not observed parenting. These results encourage consideration of parental factors such as perceived social support when selecting and interpreting a parenting measurement strategy.

Skill Profile Analysis of Struggling Readers with Non-Adequate Growth: Analysis of Two National Datasets

Xiaying Zheng, Mengyi Li, Yuan Zhang, & Thomas Sun

The importance of early reading skills for future academic success has been well documented in the literature (Claessens et al., 2009, Dogan et al., 2015). Despite the richness of early reading literature, generalizability of findings is somewhat limited especially at the national level as most previous studies use a relatively small sample size from a local or regional context. This poster presents findings on the reading skill development profile of struggling readers, which is from a larger study investigating the relationship between reading skill development trajectories from grades K to 3 and their reading performance in grade 4 using the overlap sample of two national datasets: Early Childhood Longitudinal Study (ECLS-K:2011) and the National Assessment of Educational Progress (NAEP).

For students included in the ECLS-K:2011 study, their expected fourth-grade NAEP reading scores were projected using the overlap sample of ECLS-K:2011 and 2015 NAEP grade 4 reading assessment. These estimated scores were used to classify students who were expected to perform below Basic on NAEP, which indicates unsatisfactory reading performance. To identity skill profiles and skill gaps of these struggling readers, Latent Profile Analysis was conducted for each measurement occasion using the data collected from the ECLS-K:2011 reading assessments measuring various reading subskills including print familiarity, letter recognition, vocabulary, and reading comprehension.

Understanding the development patterns of specific reading subskills for struggling readers in early grades can help teachers and practitioners provide more effective support for their students to address skill gaps and facilitate adequate growth in reading so that they can reach proficiency in reading comprehension. The poster will present more details for model specifications and results. Authors of this poster welcome discussions with fellow researchers in the developmental science discipline to improve the models and to enhance methodology for continuing research in early reading development.
Implementation of a 3-Form Planned Missing Data Design in the Context of Repeated Measures and Multiple Informants

Charlie Rioux, Natalie Castellanos-Ryan, Jean R. Séguin, & Sophie Parent

Planned missing data designs are recommended to decrease data collection costs, improve data quality and maintain statistical power while also decreasing the burden on participants. One popular planned missing data design is the 3-form design, where items are divided into one common block with 25% of the items, and 3 blocks to which 25% of the items are attributed randomly. Each of the three forms includes the common block and 2 of the 3 random blocks. Thus, each form is missing 25% of the items. This presentation will highlight the state of the current literature on the 3-form design and how this design was implemented in the 3D-transition study. The 3D study in Quebec (Canada) has followed 2366 families across pregnancy and after birth until the children were 2 years old using a cohort-sequential design (3 cohorts recruited yearly between 2010 and 2012). 1411 families agreed to a follow-up and constitute the sample for the present project (3D-transition), spanning from 2017 to 2021. A 3-form within-block design was implemented. The common block included socio-demographic information, single indicators and the most representative items of each scale. Decisions were made to maximize the information collected with multiple informants and repeated measures. Parent 1 and parent 2 filled out different versions of the form within each assessment (across informants). Furthermore, informants never had the same version within two assessments (within informants). A detailed analysis of this approach based on the methodological literature as well as rational and logistical decisions will be presented. The limitations of the current methodological literature on the 3-form design that were highlighted by its implementation in the 3D-transition study will be discussed to inform future research, which includes little guidance on using the 3-form design in large-scale cohort studies, with complex designs (e.g., nested data) and with multiple informants.

Comparison of Data Collection Methods and Analytic Approaches to Intervention Fidelity Monitoring

Taren M. Swindle, Julie M. Rutledge, James Selig, Leanne Whiteside-Mansell, & Geoff Curran

Background: Researchers face many decisions in developing a measurement tool and protocol for monitoring fidelity to complex interventions. To illustrate design and analytical decisions related to fidelity monitoring, the current study uses data evaluating a nutrition education intervention, Together, We Inspire Smart Eating (WISE), in a preschool setting to explore issues of source, timing, and frequency of fidelity monitoring.

Methods: The overall study from which these data are drawn was a pre/post design with an implementation-focused process evaluation. Between 2013 and 2016, researchers monitored fidelity to three evidence-based components of the WISE intervention in 49 classrooms in two Southern states. Data collectors obtained direct assessment of fidelity on a monthly basis in study classrooms. Research staff requested that educators provide indirect assessment on a weekly basis. We used mean comparisons (t-tests), correlations (Pearson’s r), and scatterplots to compare the direct and indirect assessments.

Results: No differences between direct and indirect assessments were statistically significant. Correlations of direct and indirect assessments of the same component for the same month ranged between -0.51 (p = 0.01) and 0.54 (p = 0.001). Scatterplots illustrate that negative correlations can be driven by individuals who are over reporting (i.e., self-report bias) and that near zero correlations reflect both raters consistently endorsing the highest fidelity levels.

Conclusion: Our findings illustrate that, on average, observed and self-reports may seem consistent despite weak correlations and individual cases of extreme over reporting by those implementing the intervention. The nature of the component to which fidelity is being monitored as well as the timing within the context of the intervention are important factors to consider when selecting the type and frequency of fidelity monitoring. Our results illustrate methodological and analytical decisions relevant to fidelity monitoring in intervention studies, which would be applicable across a variety of fields and contexts.
What are the Best Methods for Examining Self-beliefs of Aging and Psychological Change in Rural Community-dwelling Older Adults?

Anna C. McCarrey

The developmental process of aging involves ‘normal’ changes to cognitive ability such as free recall memory and executive functions (McCarrey et al., 2016). Most aging studies are conducted in metropolitan areas, thus less is known about rural aging. My research lab at Idaho State University, in rural Idaho, is ideally situated to study psychological change in rural community-dwelling older adults. As a junior faculty member, I am in the beginning phases of developing a longitudinal laboratory studying various aspects of psychological change. Testing for time point 1 is underway with an N=68. Among other results, the current first wave of cross-sectional results demonstrate that more positive self-beliefs about the aging process (as measured by the B-APQ (Sexton, King-Kallimanis, Morgan, & McGee, 2014)), is linked to higher scores on a variety of neuropsychological tests, as well as better quality of life and health. This preliminary study is the first to demonstrate an association between self-perceptions of aging and cognitive performance in older adults living in a rural setting. Future directions include examining these associations over time, within the context of cognitive change that occurs as part of the normal aging process, as well as potential interventions that may positively impact long-term self-beliefs about aging. Outstanding questions regarding methodology include duration of test-retest with older adults and whether this varies by age at baseline, sufficient power and sample size considerations given lower populations in rural areas, and the optimal analysis to best capture longitudinal change in not only cognition but other psychological outcomes such as health and well-being.

How Should Authors Move from Multilevel Linear Growth Curve Analyses to More Complex Models and Report the Results?

Danielle Riser, Henry May, & Rena Hallam

This poster presents an exploratory quantitative analysis of variations in achievement between children with disabilities and children without disabilities. Using data from the Early Childhood Longitudinal Study (2011), a series of multilevel linear individual growth-curve models were constructed to determine the trajectories of children with disabilities in comparison to children without identified disabilities in several academic and social-emotional areas from Kindergarten through Fourth Grade (Bryk & Raudenbush, 1987). The results suggest that children with disabilities have significantly lower average baseline (Fall Kindergarten) scores in the areas of reading, math, self-control, and interpersonal skills, and significantly higher average baseline scores in the areas of externalizing behaviors and internalizing behaviors. Additionally, on average, children without disabilities saw increases in their scores at a small but significantly greater rate over time than children with disabilities in reading, math, and interpersonal skills; the gap between children with and without disabilities in these areas widens over time. However, children without disabilities also had a greater rate of increase in their externalizing behaviors; the gap between children with and without disabilities in this area closes over time. Furthermore, children with disabilities on average had a greater rate of increase than children without disabilities in self-control, and internalizing behaviors; the gap between children with and without disabilities begins closing for self-control, and widens for internalizing behaviors. The challenge with this analysis is determining the next methodological step, and how to report the combined results. Several possible ideas for further analyses will be provided for exploration, including analyses controlling for factors such as race and socio-economic status, analyses comparing achievement by disability diagnosis, or time of diagnosis, and growth mixture model analyses comparing achievement by groupings. The author will request feedback on further methodological ideas for exploration, and suggestions for reporting the combined results.
Parent-Child Acculturation Status and Adolescent Language Brokering Experiences in Mexican Immigrant Families

Minyu Zhang, Su Yeong Kim, & Yang Hou

Language brokering is a transactional process where adolescents team up with their parents to interact with mainstream society, where adolescents translate and interpret for their English-limited parents (e.g., Katz, 2010). Past research has focused on the adolescent perspective in understanding the variation in language brokering experiences (e.g., adolescent acculturation, Weisskirch, 2005). Yet, it is important to also consider the parental perspectives as parents are also participants in the language brokering process.

Using the variable-center approach—the interaction—and the person-centered—latent profile analysis, we incorporate both the adolescent and the parental perspective to identify parent-adolescent acculturation status together as a predictor of variations in language brokering experiences of Mexican American adolescents. We used data from a longitudinal dataset of 604 Mexican American families’ language brokers in middle school (54.3% female) and at least one parent.

Results of interaction found that higher adolescent U.S. and Mexican orientations are associated with better language brokering experiences. Parental Mexican orientation moderates the association between adolescent Mexican orientation and language brokering experiences. The positive relations between adolescent Mexican orientations and positive language brokering experiences was stronger when their parents also reported higher Mexican orientation (+1sd), as compared to parents with lower (-1sd) Mexican orientation, adolescents. Latent profile analyses found that four profiles emerged for the mother-adolescent dyads: 1) adolescent integrated-mother separated, 2) adolescent moderately assimilated-mother moderately integrated, 3) adolescent moderately integrated-mother moderately separated, and 4) adolescent moderately integrated-mother separated; and three for father-adolescent dyads, which were similar to the three found for adolescent-mother profiles. Brokers in adolescent integrated-parent moderately separated profile were found to be most adaptive as it related to higher positive brokering experiences than other profiles.

Findings were consistent across both approaches, suggesting that integrated adolescents (high Mexican and U.S. orientation) who cooperate with enculturated parents may create the optimal language brokering experience.