Course objective: To develop fundamental ideas and basic techniques for analyzing panel data from a structural equation modeling (SEM) perspective (using Mplus software).

Themes: The course will first compare two images of change and demonstrate how different images of change generate different models of change. One image, residualized change scores, generalizes to autoregressive (AR) models, important examples of which are cross-lagged and contemporaneous models of stability and change. These models are often used to provide insight into the relative causal direction of change over time. We will estimate some basic cross-lagged and synchronic models.

In contrast, images of absolute change generalize to latent growth curve (LGC) models. Our discussion of LGCs begins by developing the basic univariate model. The univariate model will be elaborated to extend the linear (straight line) model to piecewise and higher-order polynomials; to compare 2nd-order “factors-of-curves” and “curves-of-factors;” and to compare LGC models in one group with those in another (multiple group analysis: males vs females; married vs single; etc). To take the mystery out of LGCs, we will use the basic 2-wave and 3-wave models to demonstrate how variances of latent intercepts and slopes can be derived from the variances and covariances of observed variables.

Once fundamentals are established, the remaining portion of the course will extend the univariate LGC model to more complex designs and to multivariate analyses that take into account time-invariant and time varying covariates. Particularly important is the idea of “interlocking trajectories,” which means that change in one LGC is correlated with change in another. When interlocking trajectories are ordered in a hypothesized causal sequence, the total effects of level and change in one variable on the level and change in another variable can be decomposed into its direct and indirect (mediating) components. This discussion is followed by examining special models that take into account complex sampling and heterogeneous populations. First, we will estimate LGC models based on cohort sequence designs whereby some cases are added and others removed from a panel at each point in time. Second, we will experiment with growth mixture models which estimate different growth curves for distinct homogeneous subpopulation in a sample. Finally, we will return to topics that bring LGC and AR models together, as represented by latent difference score models. Depending on time, we may also discuss models with interactions and approaches to missing data.


Evaluation: There will be weekly assignments, most of which will apply models of change to real world panel data.
Course outline (10 scheduled meeting). Below are the topics in likely order of presentation. (There are more topics listed than we can cover).


**Topic 5: Multiple group comparisons.** Strategies for comparing two or more independent groups (e.g., men vs. women; married vs. divorced). Read Duncan et al (2006) Chapter 5.


**Topic 8: Latent difference scores.** Introduction to techniques that bring LGC and AR models closer together. Read J. J. McArdle (2009), Latent variable modeling of differences and changes with longitudinal data. Annual Review of Psychology, 60: 577- 605. A good example is Dogan et al. (2010), Developmental relations and patterns of change between alcohol use and the number of sexual partners from adolescence through adulthood, Developmental Psychology 69, 577 – 605.


**Topic 10: Missing data models.** Data are missing in panel studies because participants drop out, skip a wave of data collection and don’t respond to questions. Read Duncan et al. (2006), Chapter 11.