ICPSR Summer Program in Quantitative Methods of Social Research

*Dynamical Systems Analysis Workshop* | June 15 – 18, 2020

**Instructors:** Jonathan Butner and Brian Baucom

**Day and Time:** 6/15 (Monday) – 6/18 (Thursday), 9:00 AM – 5:00 PM

**Location:** On-line, website details will be provided in June

**E-mail:** jonathan.butner@psych.utah.edu and brian.baucom@psych.utah.edu

---

**Course Description**

Research focused on how individuals, families, groups, and communities grow and change over time is increasingly recognizing the vast potential of dynamic systems models for advancing understanding of complex temporal phenomena. Dynamic systems models provide a unique lens for studying change over time; the focus in these models is on how fluctuations about the mean form patterns that emerge over time, how stable these patterns are, how stability is affected by different variables in the system, and how these patterns change under different conditions. This course provides an applied introduction to the statistical methods used in dynamic systems modes, including discussion of how to think about research questions from a dynamical systems perspective, how to generate dynamical systems hypotheses, and how to interpret results of dynamical systems analyses. This workshop includes a balance of didactic instruction in background material, introduction to constructing different types of dynamical systems models that correspond to different hypotheses, and guided practice in data preparation, data set construction, model estimation, and interpretation. No previous experience with dynamical systems modeling is necessary.

The four day course consists of morning and afternoon sessions each day, both of which involve a combination of video-recorded lecture and live discussion and hands-on application. Students are strongly encouraged to bring their own data sets to assist with generalization of course ideas to individual projects. Scheduled, one-on-one consultation time with course instructors will be available each afternoon of the course as well as during the second half of the final day of the workshop; additional one-on-one consultation with course instructors will be made available via phone and web conference on an as needed basis. Hands-on course examples will utilize SPSS and R software packages (both of which will be provided to all students at no cost for the duration of the workshop); code for conducting course examples in Stata and SAS will be provided. No specialized statistical knowledge or training is needed beyond a basic understanding of linear regression. Course instructors welcome questions from potential students regarding course appropriateness for potential student’s research designs/questions, readiness for the course, additional specifics of course content, etc.
Schedule

Monday, 6/15
Morning (9am – 12:30pm) – Welcome and introduction to dynamical systems theory
Afternoon (1:30pm – 5pm) – Estimating 1 dimensional dynamical systems models in Ordinary Least Squares (OLS) regression, assumptions of 1 dimensional models

Tuesday, 6/16
Morning (9am – 12:30pm) – Introduction to multi-stability, adding control parameters to 1 dimensional models
Afternoon (1:30pm – 5pm) – Estimating 1 dimensional dynamical systems models for multiple time series in Multilevel Models

Wednesday, 6/17
Morning (9am – 12:30pm) – Estimating 2 dimensional dynamical systems models in OLS regression
Afternoon (1:30pm – 5pm) – Estimating 2 dimensional dynamical systems models for multiple time series in MLM

Thursday, 6/18
Morning (9am – 12:30pm) – Intermediate and advanced topics including estimating and calculating derivatives, estimating 1 and 2 dimensional dynamical systems models in Structural Equation Modeling
Afternoon (1:30pm – 5pm) – Individualized consultation

In addition to the scheduled workshop content, we also provide three optional lectures:

Optional lecture 1) Review of key concepts in linear regression
Optional lecture 2) Review of centering in multilevel models
Optional lecture 3) Introduction to MLM in R

These optional lectures discuss key concepts in variable manipulation, model construction, and interpretations of results that are core to the DSA analyses that we will focus on in the workshop. If it has been a while since you’ve run an interaction model and/or if you’re new to MLM or R, we strongly encourage you to watch these lectures prior to viewing the workshop lectures. Optional lecture 1 is most helpful before Monday’s afternoon lecture on estimating 1 dimensional DSMs, and optional lectures 2 and 3 are most helpful before Tuesday afternoon’s lecture on estimating 1 dimensional DSMs for many time series.