Introduction to Structural Equation Modeling

Location: CIQSS, 3535 Queen-Mary, Suite 420, Montréal
Dates: April 18–22, 2016

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Trainer

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Eligibility and Registration

The course is open to graduate students and postdoctoral fellows as well as to professors and applied researchers. The seminar is limited to a maximum of 20 participants registered on a first-come, first-served basis. Online registration will take place on the CIQSS web site. Contact and registration information:

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CIQSS website, http://www.ciqss.umontreal.ca/

Description and Content

The sessions are in English. This five-day seminar introduces structural equation modeling (SEM). Core SEM techniques, such as path analysis and confirmatory factor analysis (CFA), are covered, and examples of applying SEM to actual research problems are considered. The presentation will be conceptually rather than mathematically oriented. Basic familiarity with multiple regression and exploratory factor analysis is assumed. There is also an opportunity for those with no prior experience using a computer tool for SEM to practice on-site with the student version of LISREL. Even if participants eventually use a different SEM computer tool in their own work, principles learned from working with LISREL will generalize to related applications.

Seminar Web Page and Computer Tools

From the seminar web page you can download the slides and articles in PDF format and also computer syntax, data, and output files in either text (ASCII) or PDF format for analysis examples. The address is

http://psychology.concordia.ca/fac/kline/sem/qicss.html

Computer practice sessions use the student version of LISREL 9.2 for Windows platform computers. It can be freely downloaded from
http://www.ssicentral.com/lisrel/student.html

The Ωnyx graphical SEM computer program will be demonstrated. It runs under the Java Runtime Environment (version 1.6 or later) on Windows, Macintosh, or Linux platform computers and can be freely downloaded from
http://onyx.brandmaier.de/

Daily Schedule

Morning			Afternoon	
9:30–11:0am	Session 1		1:30–3:00pm	Session 3
11:15am–12:15pm	Session 2		3:15–4:45pm	Session 4

Topics and Computer Exercises

Computer exercises with LISREL take place on Tuesday and Wednesday from 1:15–1:45pm, and the demonstration with Ωnyx is for Thursday at the same time.

Day	Topics and exercises
M	Background concepts, data preparation, types of models, computer tools
T	Path analysis, estimation, local fit testing LISREL syntax analysis
W	Global fit testing, comparing hierarchical or non-hierarchical models LISREL graphical editor analysis
Th	CFA vs. EFA, testing measurement hypotheses, analyzing ordinal data Ωnyx demonstration
F	SR models, two-step modeling, reflective vs. formative measurement

Main Source (Optional)

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York: Guilford Press. (Book resource site at http://www.guilford.com/kline)

Other Readings (See seminar web page)

Hoyle, R. H., & Isherwood, J. C. (2013). Reporting results from structural equation modeling analyses in *Archives of Scientific Psychology*. *Archives of Scientific Psychology*, *1*, 14–22.

Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Y. Petscher & C. Schatschneider (Eds.), *Applied quantitative analysis in the social sciences* (pp. 171–207). New York: Routledge.

MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, *51*, 201–226.

McCoach, D. B., Black, A. C., & O'Connell, A. A. (2007). Errors of inference in structural equation modeling. *Psychology in the Schools*, *44*, 461–470.

Tomarken, A. J., & Waller, N. G. (2005). Structural equation modeling: Strengths, limitations, and misconceptions. *Annual Review of Clinical Psychology*, *1*, 31–65.

⚙ LISREL Practice

These exercises are easier if your computer shows file names with extensions. Variable names in LISREL are case sensitive and limited to 8 characters in length. Syntax is executed by clicking on the Run LISREL icon, or 🔬. If the analysis is successful, displayed in the Path Diagram window is

Chi-Square=11.11, df=5, P-value=0.04929, RMSEA=0.057

Exercise 1 (Tuesday). LISREL SIMPLIS syntax:

1. Create a new SIMPLIS syntax file: select File | New | Syntax Only, and then save the file as `roth.spl`

2. Study the syntax list next for the example path model:

```
four-variable example
observed variables
 neg_str cur_prob prob_sol depress
covariance matrix
 76.913
 55.668 249.324
 33.757 115.685 478.297
 21.775  53.614  60.695 37.700
sample size is 205
relationships
 cur_prob = neg_str
 prob_sol = neg_str cur_prob
 depress = neg_str cur_prob prob_sol
LISREL output: ND = 3 SC RS MI
path diagram
end of problem
```
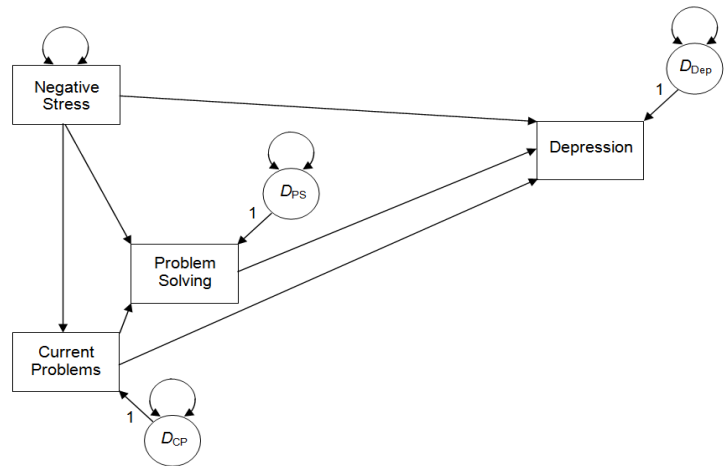
3. Adapt the syntax just shown for the data and model presented next for *N* = 373:

```
exercise, hardy, fitness, stress, illness

4422.250
 -75.810 1444.000
 477.204    48.944   338.560
-111.388 -292.790   -80.132 1122.250
-332.394 -379.878 -333.393   711.647 3903.750
```
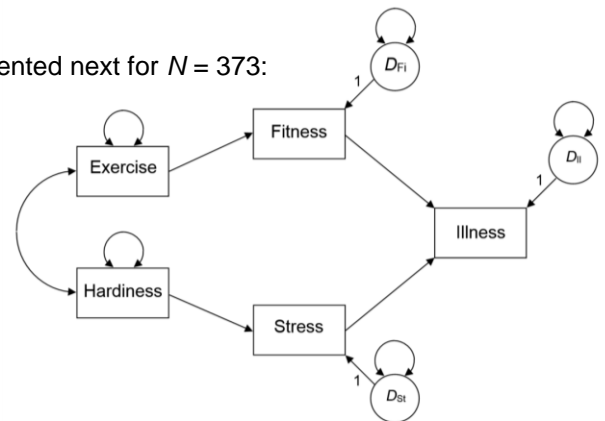
Exercise 2 (Wednesday). LISREL Path Diagram:

1. Save just the covariances (without labels) in the text file `roth.cov`

2. Create a new path diagram: select File | New | Path Diagram, and then save the diagram as `roth.pth`

3. These steps will be demonstrated in class, but you can try them on your own: Use the Setup menu to specify the data file, variable names, and sample size before drawing the model on the screen. Check the boxes for the endogenous variables (Observed Y) before dragging and dropping the observed variables from the list to the drawing palette. Select View | Toolbars | Drawing Bar to display the shape tools, if not already visible.

4. When the diagram is finished, select Setup | Build SIMPLIS syntax, and then run it.