

STATSU webinar:
Path Analysis using Mplus lab session

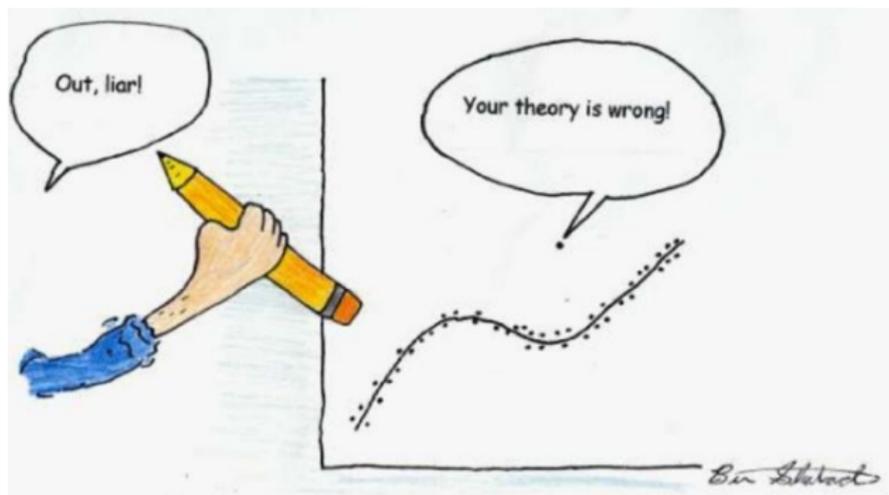
RME—Research, Measurement, and Evaluation

June 4, 2020

Welcome! Mplus lab session: path analysis

“If a **model** is consistent with reality, then the **data** should be consistent with the **model**. But if the **data** are consistent with the **model**, this does not imply the **model** corresponds to reality”

-K. A. Bollen



Outline

- 1 Resources
- 2 Path analysis
- 3 Mplus basics
- 4 Importing data
- 5 DATA & VARIABLE
- 6 MODEL
- 7 Examples

University of Miami virtual lab for Mplus:

<https://vlabs.it.miami.edu/>

Text editor

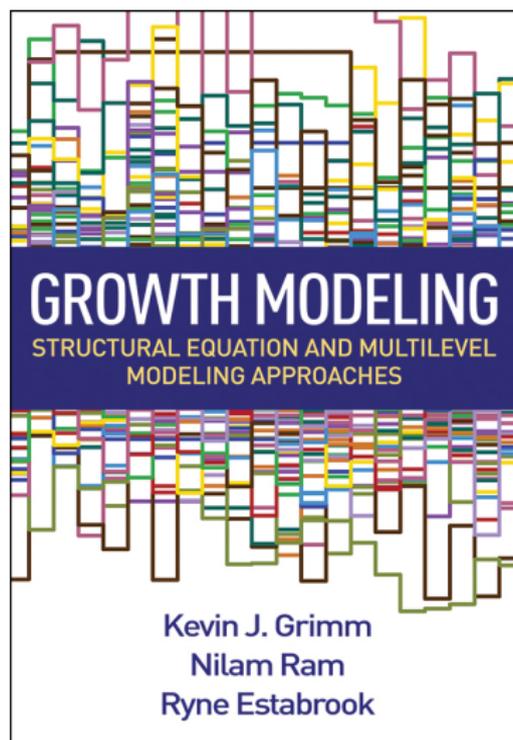
<https://www.sublimetext.com/>

Mplus website:

<https://www.statmodel.com/>

Model identification:

http://davidakenny.net/cm/identify_formal.htm



Code provided for SEM and MLM framework: Mplus, R, SAS

A influences, or causes B
 $A \longrightarrow B$

X and Y covary
 $X \longleftrightarrow Y$

Sample size:

5 to 20 observations per estimated parameter is needed, on average.

All models require justified theory and remember...

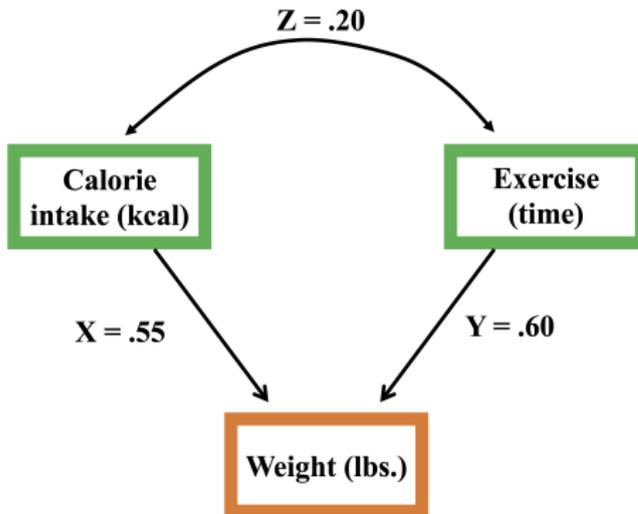
this method is disconfirmatory!

Exogenous/gives causal input = A
Endogenous/receives causal input = B

Notation

	<u>Diagram Symbol</u>	<u>Notation</u>	<u>Mplus</u>
<i>Manifest variable:</i> directly observed, and measured Exogenous variable = X Endogenous variable = Y		X	X
		Y	Y
<i>Latent variable:</i> directly observed, and measured (not used in path analysis)		ξ xi η eta	F
<i>Structural effects coefficients:</i> Slope (factor loadings in SEM)	Numeric value or β_{11} or λ_{11} λ_{12} ... λ_{22} first subscript = DV second subscript = IV	β beta λ lambda	MODEL RESULTS values
<i>Manifest variable error (also called residual):</i> Error term for observed variables	u, d, e, $\epsilon_1, \epsilon_2, \epsilon_3, \dots$	ϵ epsilon	E
<i>Latent variable error (also called residual or disturbance):</i> Error term for observed variables		δ delta ξ zeta	D

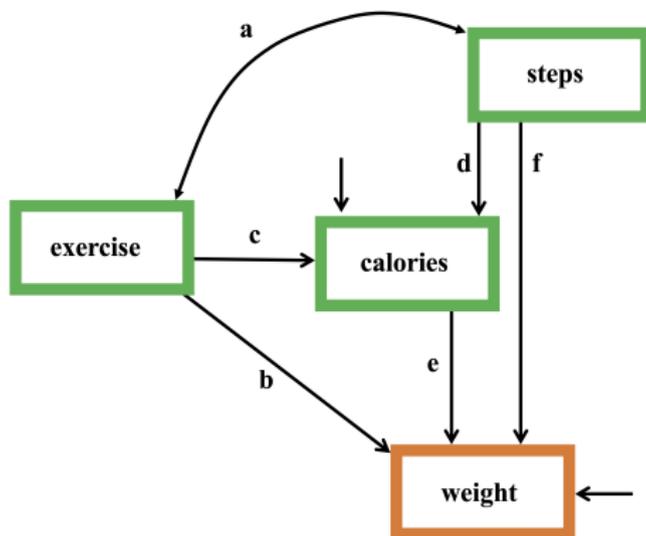
Path analysis example



Path variables	Direct effect	Indirect effect	Spurious associations	Total Correlation
IV1 IV2			Z	
IV1 DV	X		ZY	X + ZY
IV2 DV	Y		ZX	Y + ZX

Path variables	Direct effect	Indirect effect	Spurious associations	Total Correlation
IV1 DV	.55		.67	.67
IV2 DV	.60		.71	.71
IV1 IV2			.20	

Example



Model fit

Joint criteria is recommended
e.g., $CFI \geq .96$ & $SRMR \leq .10$

- 1 Loglikelihood: compares nested models (deviance)
 H_0 Value: null model $p < .05$
- 2 Information Criteria: non-nested models
AIC, BIC, SBIC: *smallest value*
- 3 RMSEA and SRMR
value $< .05$
- 4 CFI/TLI: (comparative fit index & Tucker-Lewis Index¹)
value $> .95$
literature can support values above .90 as acceptable
- 5 χ^2 test for baseline
Baseline is a null model $p < .05$

¹NNFI is another name for TLI

Mplus

- 1 Text editor (Sublime Text/Vim/notepad...)
SPSS or R/SAS/Julia
Link: R package: `MPlusAutomation`
- 2 .dat or .csv text files only
- 3 Comment Mplus code: ! `<code-not-run>` ;
- 4 Mplus will not read past 80 characters
Link: good v. bad coding
- 5 Primary commands are color coded in **BLUE**, lines end with a ;
- 6 Code will run for the entire file
- 7 Missing data: accepts empty cells. -9999 is defined as missing
- 8 Mplus files are .inp for the syntax and .out for results

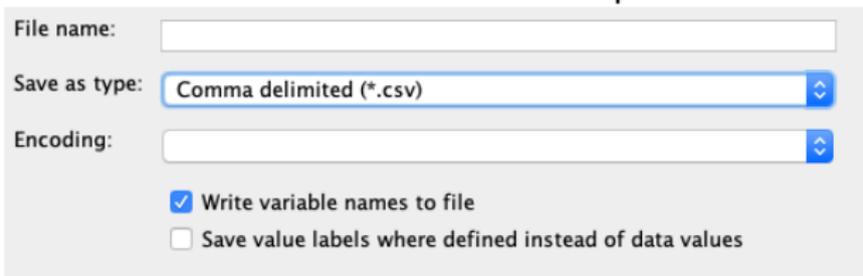
SPSS to Mplus

SPSS convert to Mplus-friendly .csv file:

File > Save as>
select *.csv file

save as type box

uncheck: “write variable names to spreadsheet” or



The screenshot shows the 'Save As' dialog box in SPSS. It contains the following elements:

- File name:** An empty text input field.
- Save as type:** A dropdown menu currently set to 'Comma delimited (*.csv)'.
- Encoding:** A dropdown menu with a blue arrow icon on the right.
- Options:** Two checkboxes are visible:
 - Write variable names to file
 - Save value labels where defined instead of data values

Mplus commands

```
DATA: ! required;  
VARIABLE: ! required;  
MODEL:  
OUTPUT:  
  
! OTHER commands;  
  
TITLE:  
DEFINE:  
SAVEDATA:  
ANALYSIS:
```

Note

1. Viewing data and data tidying in alternative text editor/program.
2. Labels and names restricted to 8 characters
3. Every variable in data set must be initialized
4. **TITLE:** Print text at the beginning of your .out file

DATA/VARIABLE

DATA

Data type to be processed: tab-,space-,comma-delimited text

.dat files with:

white space delimiter: 100 200

comma-delimiter: 100,200

Windows: shift key then right click on any file and select "copy as path name"

Mac OS: CTL then right click on any file, press OPT: "copy as path name"

DATA/VARIABLE

VARIABLE NAMES ARE var1 var2 var3;

VARIABLE NAMES ARE var1-var3;

USEVARIABLES = <list what will be used in the model command>;

VARIABLE NAMES ARE var1-var9;

USEVARIABLES = var2-5 var8;

DATA/VARIABLE

VARIABLE

CATEGORICAL = <ranked/ordinal>

NOMINAL = <no ranks>

CENSORED =

right-censoring (from values above):

food scale at market is 20lbs. – placing an item weighing 30 lbs.
will read 20 lbs. Only know the maximum value.

left-censoring (from values below):

medical tests have set sensitivities, antibodies below the threshold
are false-negative results. Only floor values known.

Validate import!

OUTPUT: SAMPSTAT

Means, variances/covariances for continuous variables

Frequency table for categorical data.

DEFINE

DEFINE:

```
new = <existing_var_name> + 100;
```

```
new = IF <existing_var_name> EQ 100  
      THEN <new_var_name> = 1;
```

MODEL

! ON defines change/influence/slope;

MODEL: Y ON X1; ! X1 impacts the value of Y;

! endogenous/dep. var. = exogenous/indep. var.;

! WITH defines covariance;

MODEL: X1 WITH X2; ! X1 and X2 are associated;

Mplus Example: 3.11

UM virtual lab : <https://vlabs.it.miami.edu/>

Mplus examples website for dataset:

<https://www.statmodel.com/usersguide/chapter3.shtml>

1. Right click data and save data: "ex3.11.dat"
2. Write syntax (or download "ex3.11.inp") in same location with ex3.11.dat; then click run to produce output.

```
TITLE:      Example of a path analysis  
            with continuous dependent variables  
  
DATA:      FILE IS ex3.11.dat;  
  
VARIABLE: NAMES ARE y1-y3 x1-x3;  
  
MODEL:     y1 y2 ON x1 x2 x3;  
            y3 ON y1 y2 x2;
```

Can also click Diagram from menu to produce your structural figure.

Questions?

Thank you!