Using M*plus* to fit and test measurement and structural equation models

Video 9

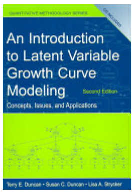
Latent Growth Models - LGMs

Department of Psychology, Faculty of Human Sciences, Macquarie University 2015

Topics

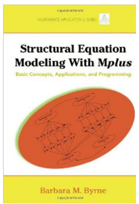
- Introduction to LGMs
- A demonstration of fitting an LGM with simulated data
- An LGM with observed variables as indicators
- An LGM with latent variables as indicators
- A parallel process LGM
- An LGM with data MNAR

Sources of Information on LGMs



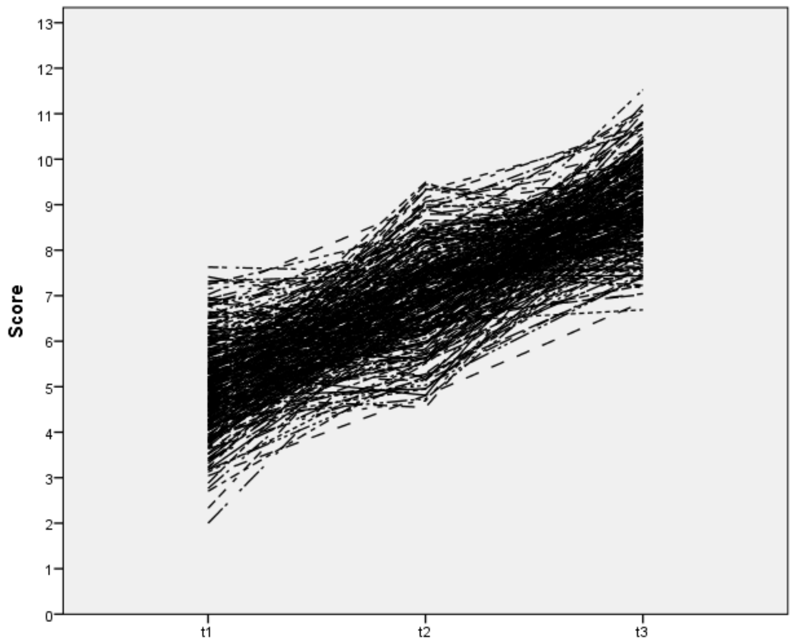
An Introduction to Latent Variable Growth Curve Modeling: Concepts, Issues, and Applications Terry E. Duncan, Susan C. Duncan, Lisa A. Strycker, 2006

An Introduction to Latent Growth Curve Modeling Duncan, Terry E. ; Duncan, Susan C. *Behavior Therapy*, 2004, Vol.35(2), p.333-363

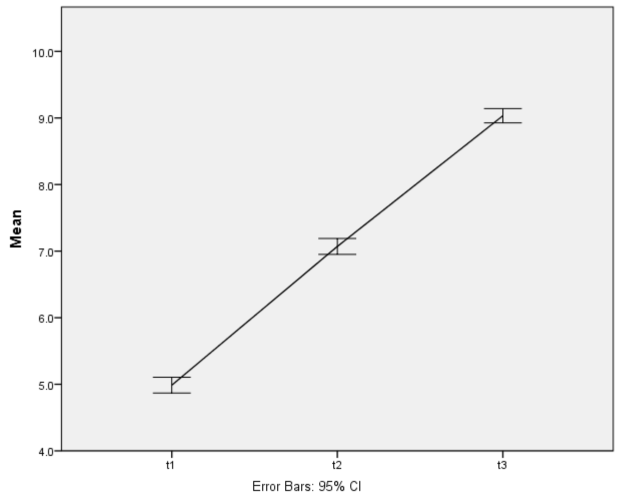


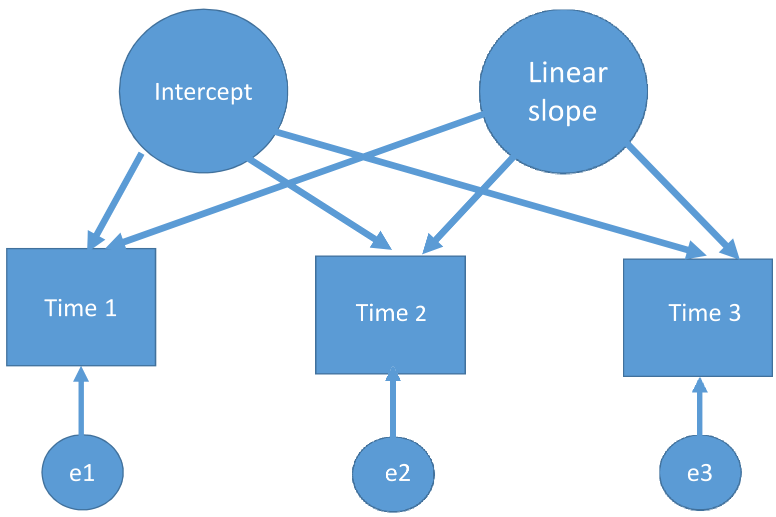
Barbara Byrne – Chapter 11

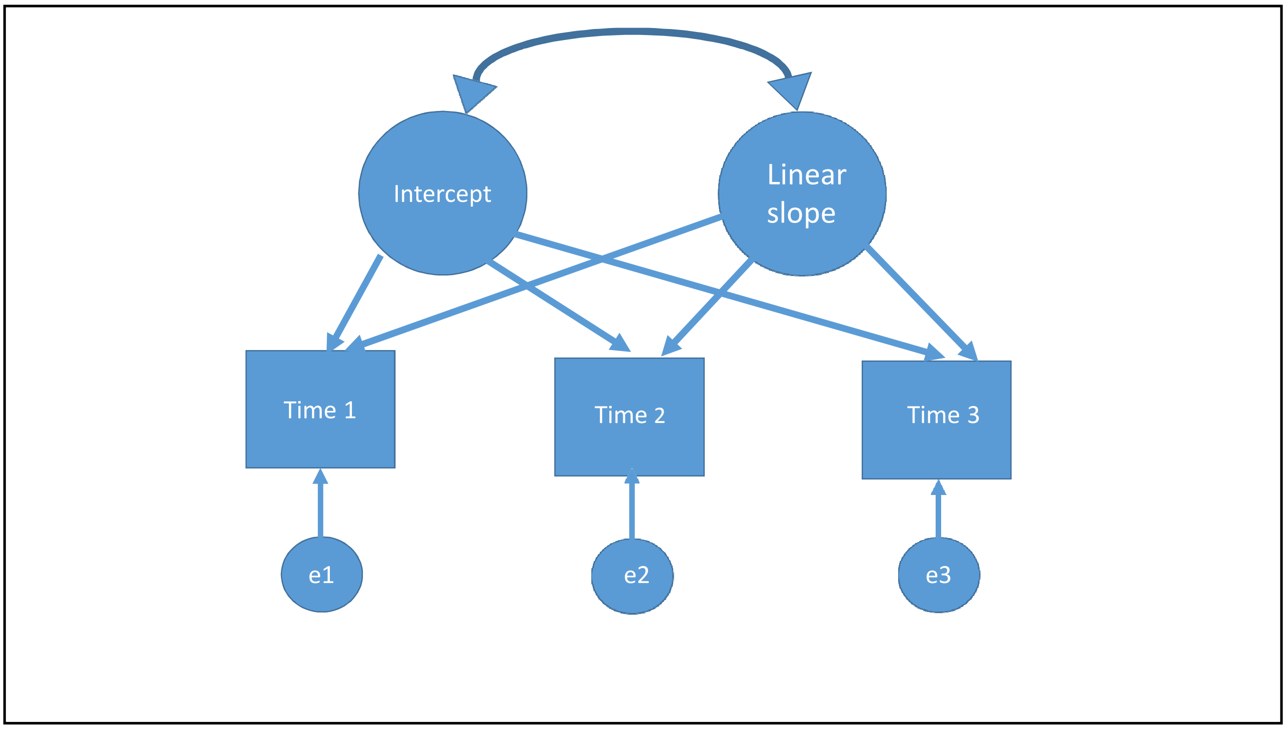
Simulated data
N=278

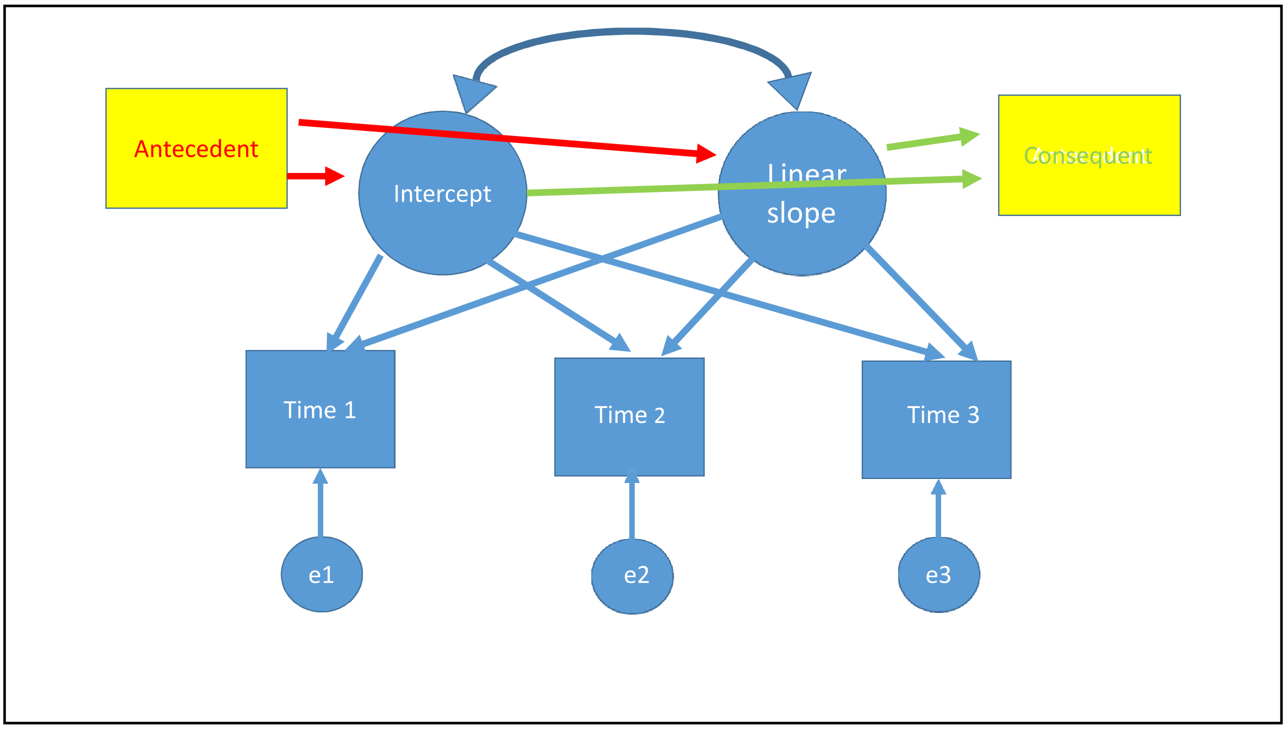


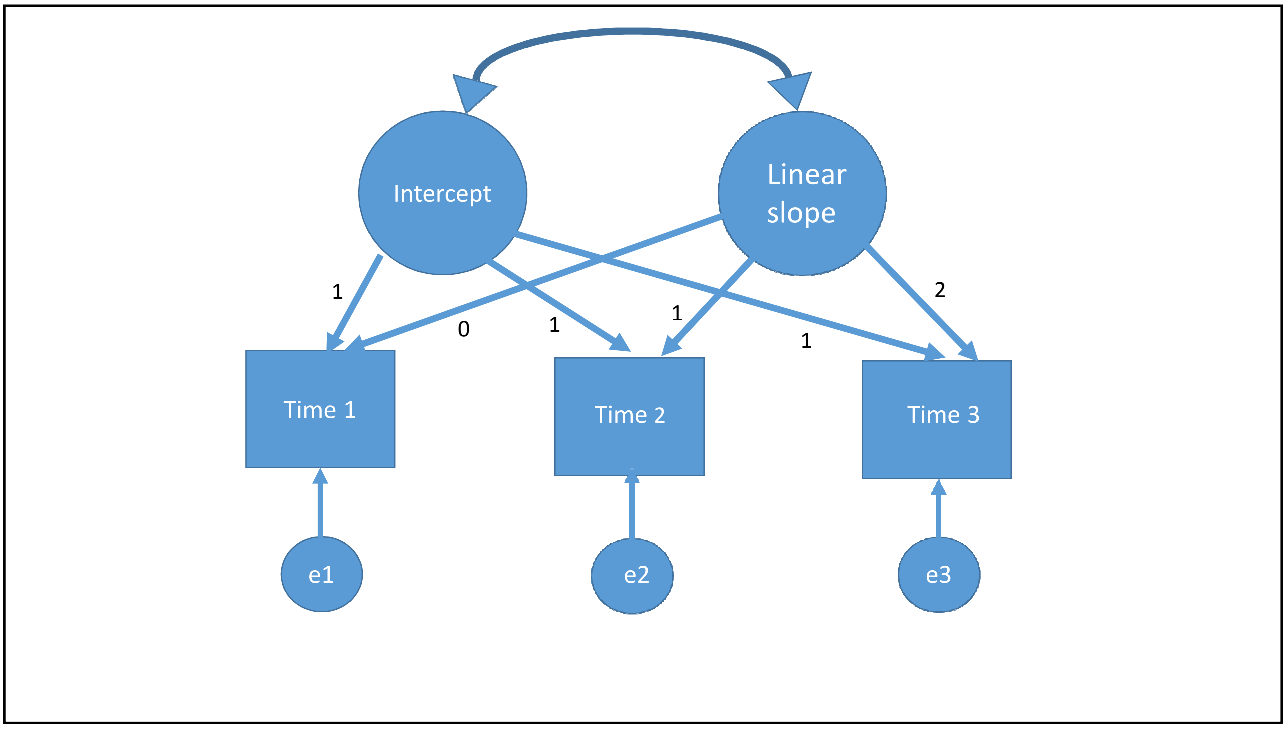
Means and 95% CIs for simulated data

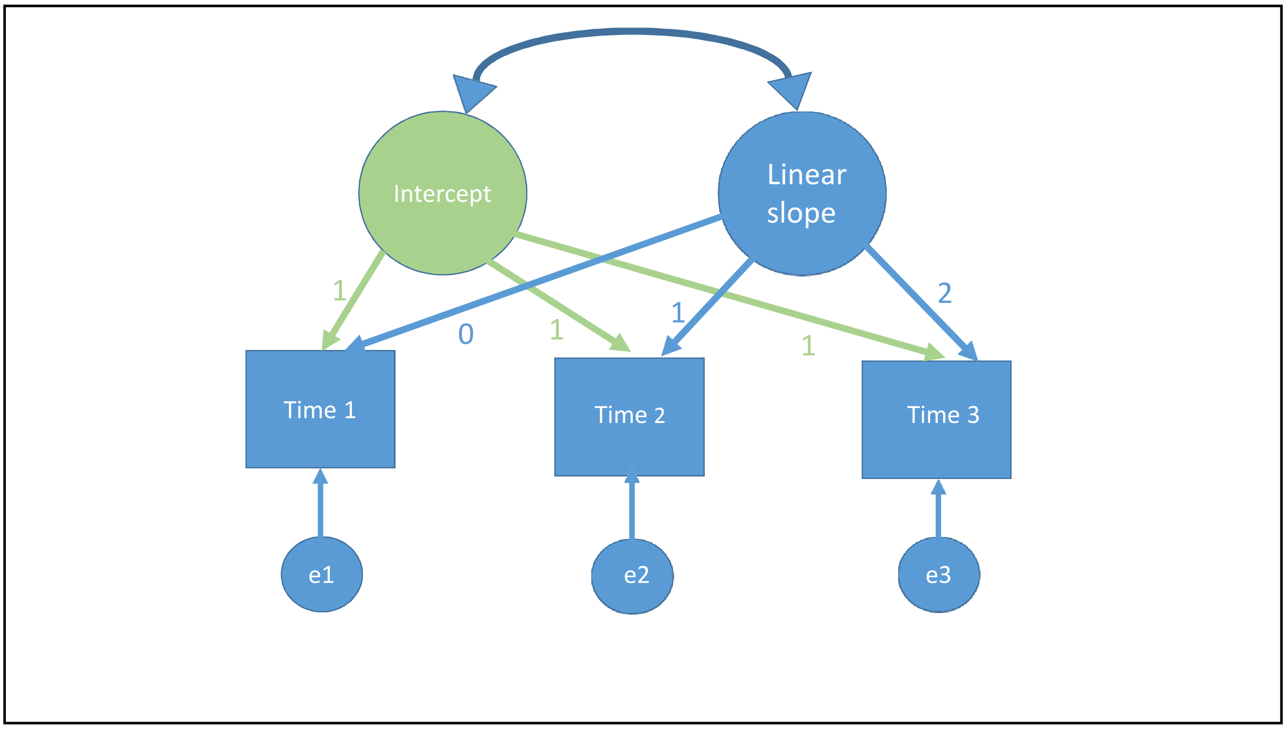


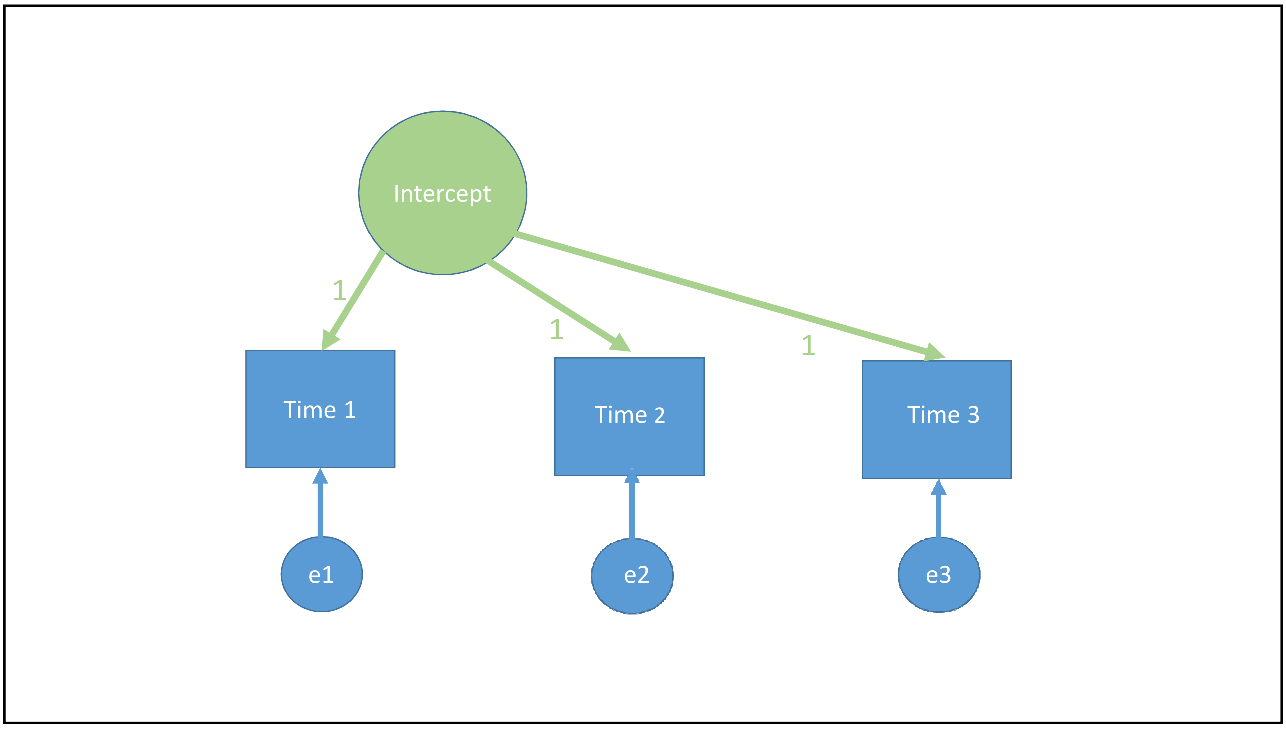


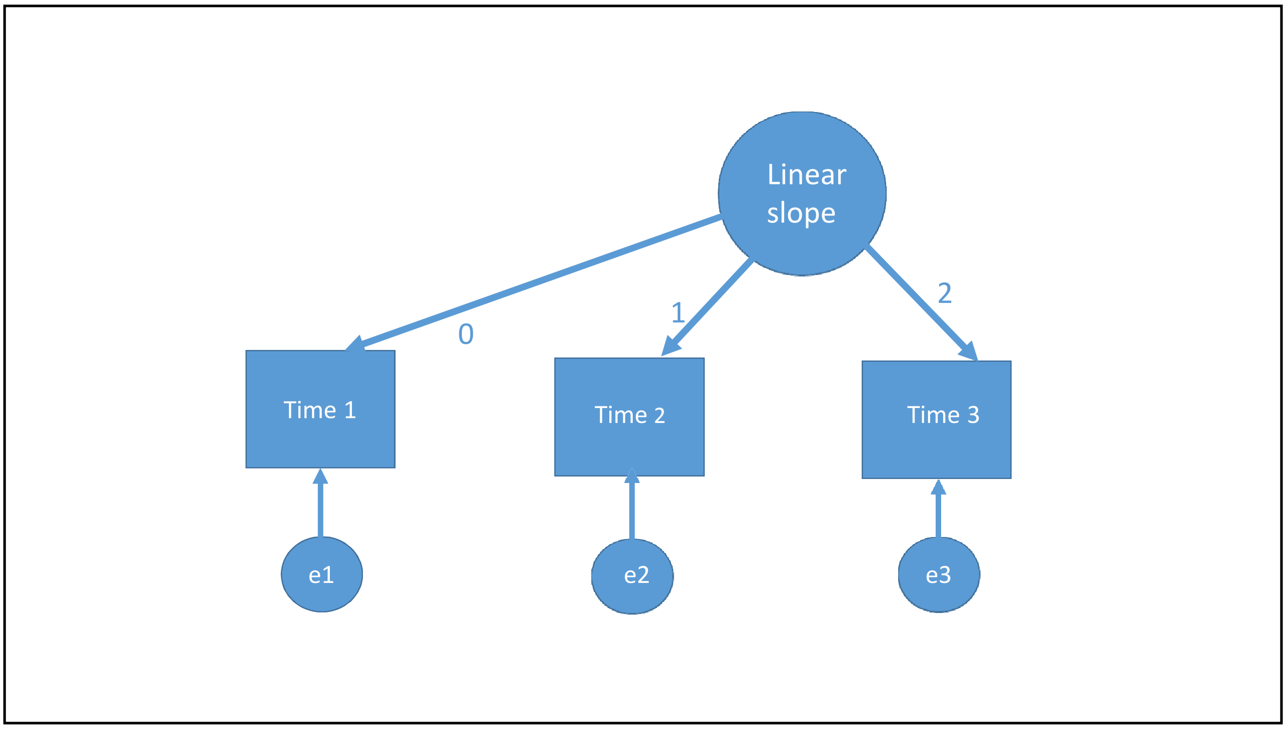

Intercept
Linear slope
Time 1
Time 2
Time 3
e1
e2
e3

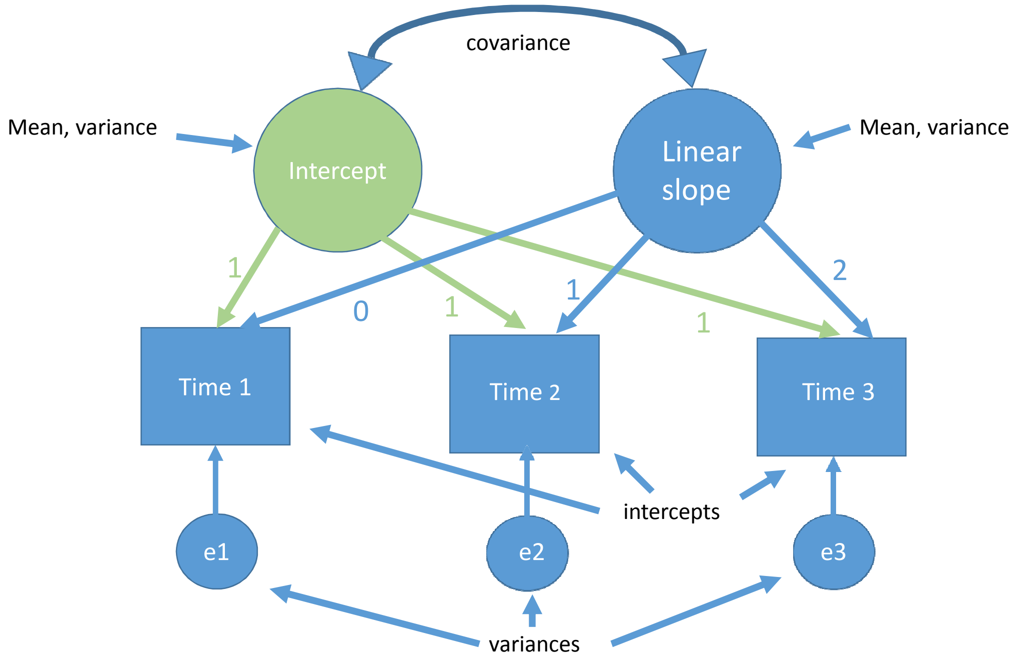

Antecedent
Intercept
Linear slope
Consequent
Time 1
Time 2
Time 3
e1
e2
e3


Intercept
Linear slope
1
0
1
1
2
1
Time 1
Time 2
Time 3
e1
e2
e3


Intercept
Linear slope
1
0
1
1
2
1
Time 1
Time 2
Time 3
e1
e2
e3


Intercept
1
1
1
Time 1
Time 2
Time 3
e1
e2
e3


Linear
slope
0
1
2
Time 1
Time 2
Time 3
e1
e2
e3



model: int by mp1@1 mp2@1 mp3@1;
lin by mp1@0 mp2@1 mp3@2;

```
                    Estimate       S.E.  Est./S.E.    P-Value

 INT      BY
    MP1                1.000      0.000    999.000    999.000
    MP2                1.000      0.000    999.000    999.000
    MP3                1.000      0.000    999.000    999.000

 LIN      BY
    MP1                0.000      0.000    999.000    999.000
    MP2                1.000      0.000    999.000    999.000
    MP3                2.000      0.000    999.000    999.000

 LIN      WITH
    INT               -0.081      0.078     -1.030      0.303

 Intercepts
    MP1                4.986      0.060     83.061      0.000
    MP2                7.070      0.061    116.551      0.000
    MP3                9.034      0.054    166.626      0.000

 Variances
    INT                0.213      0.130      1.640      0.101
    LIN                0.051      0.064      0.792      0.428

 Residual Variances
    MP1                0.789      0.145      5.449      0.000
    MP2                0.921      0.089     10.406      0.000
    MP3                0.725      0.131      5.531      0.000
```

model: int lin | mp1@0 mp2@1 mp3@2;

```
                    Estimate       S.E.  Est./S.E.    P-Value

 INT      |
    MP1                1.000      0.000    999.000    999.000
    MP2                1.000      0.000    999.000    999.000
    MP3                1.000      0.000    999.000    999.000

 LIN      |
    MP1                0.000      0.000    999.000    999.000
    MP2                1.000      0.000    999.000    999.000
    MP3                2.000      0.000    999.000    999.000

 LIN      WITH
    INT               -0.080      0.078     -1.014      0.311

 Means
    INT                5.005      0.056     88.723      0.000
    LIN                2.023      0.039     51.432      0.000

 Intercepts
    MP1                0.000      0.000    999.000    999.000
    MP2                0.000      0.000    999.000    999.000
    MP3                0.000      0.000    999.000    999.000

 Variances
    INT                0.211      0.130      1.623      0.105
    LIN                0.050      0.064      0.774      0.439

 Residual Variances
    MP1                0.791      0.145      5.449      0.000
    MP2                0.924      0.089     10.406      0.000
    MP3                0.727      0.131      5.531      0.000
```

```
MODEL:     i s | y11@0 y12@1 y13@2 y14@3;
```

The MODEL command is used to describe the model to be estimated. The | symbol is used to name and define the intercept and slope factors in a growth model. The names i and s on the left-hand side of the | symbol are the names of the intercept and slope growth factors, respectively. The statement on the right-hand side of the | symbol specifies the outcome and the time scores for the growth model. The time scores for the slope growth factor are fixed at 0, 1, 2, and 3 to define a linear growth model with equidistant time points. The zero time score for the slope growth factor at time point one defines the intercept growth factor as an initial status factor. The coefficients of the intercept growth factor are fixed at one as part of the growth model parameterization. The residual variances of the outcome variables are estimated and allowed to be different across time and the residuals are not correlated as the default.

In the parameterization of the growth model shown here, the intercepts of the outcome variables at the four time points are fixed at zero as the default. The means and variances of the growth factors are estimated as the default, and the growth factor covariance is estimated as the default because the growth factors are independent (exogenous) variables. The default estimator for this type of analysis is maximum likelihood. The ESTIMATOR option of the ANALYSIS command can be used to select a different estimator.

The data used in the following examples were collected by Sue Greig, a Macquarie University doctoral student, for her thesis entitled

The determinants of emotionally healthy parenting and the transmission of emotion regulation from parent to child.
Sydney, Australia : Macquarie University, 2014.

Sue's supervisor was Dr Carolyn Schniering.

I'm grateful to Sue for allowing me to use her data for these videos.

THE PLOT COMMAND

User's Guide, p. 762

The PLOT command is used to request graphical displays of observed data and analysis results. These graphical displays can be viewed after the analysis is completed using a post-processing graphics module.

Following are the options for the PLOT command:

PLOT:		
TYPE IS	**PLOT1**;	
	PLOT2;	
	PLOT3;	
SERIES IS	list of variables in a series plus x-axis values;	
FACTORS ARE	names of factors (#);	
LRESPONSES ARE	names of latent response variables (#);	
OUTLIERS ARE	**MAHALANOBIS**;	
	LOGLIKELIHOOD;	
	INFLUENCE;	
	COOKS;	
MONITOR IS	**ON**;	OFF
	OFF;	

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Shorter communication

Child involvement, alliance, and therapist flexibility: Process variables in cognitive-behavioural therapy for anxiety disorders in childhood

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[e] *National Institute of Mental Health, United States*

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ABSTRACT

Background: This study examined the relations between treatment process variables and child anxiety outcomes. Method: Independent raters watched/listened to taped therapy sessions of 151 anxiety-disordered (6–14 yr-old; $M = 10.71$) children (43% boys) and assessed process variables (child alliance, therapist alliance, child involvement, therapist flexibility and therapist functionality) within a manual-based cognitive-behavioural treatment. Latent growth modelling examined three latent variables (intercept, slope, and quadratic) for each process variable. Child age, gender, family income and ethnicity were examined as potential antecedents. Outcome was analyzed using factorially derived clinician, mother, father, child and teacher scores from questionnaire and structured diagnostic interviews at pretreatment, posttreatment and 12-month follow-up. Results: Latent growth models demonstrated a concave quadratic curve for child involvement and therapist flexibility over time. A predominantly linear, downward slope was observed for alliance, and functional flexibility remained consistent over time. Increased alliance, child involvement and therapist flexibility showed some albeit inconsistent, associations with positive treatment outcome. Conclusion: Findings support the notion that maintaining the initial high level of alliance or involvement is important for clinical improvement. There is some support that progressively increasing alliance/involvement also positively impacts on treatment outcome. These findings were not consistent across outcome measurement points or reporters.

Thanks to Professor Jennifer Hudson, Centre for Emotional Health, Department of Psychology, Macquarie University, for allowing me to use these data.