Structural Equation Modeling

The SIMPLIS Command Language

Anne Boomsma

Department of Statistics & Measurement Theory
University of Groningen

April 3, 2008

`sem16.she`

The SIMPLIS Command Language

Stability of Alienation model

— Wheaton, Muthén, Alwin & Summers (1977)

Used to illustrate the different SIMPLIS commands

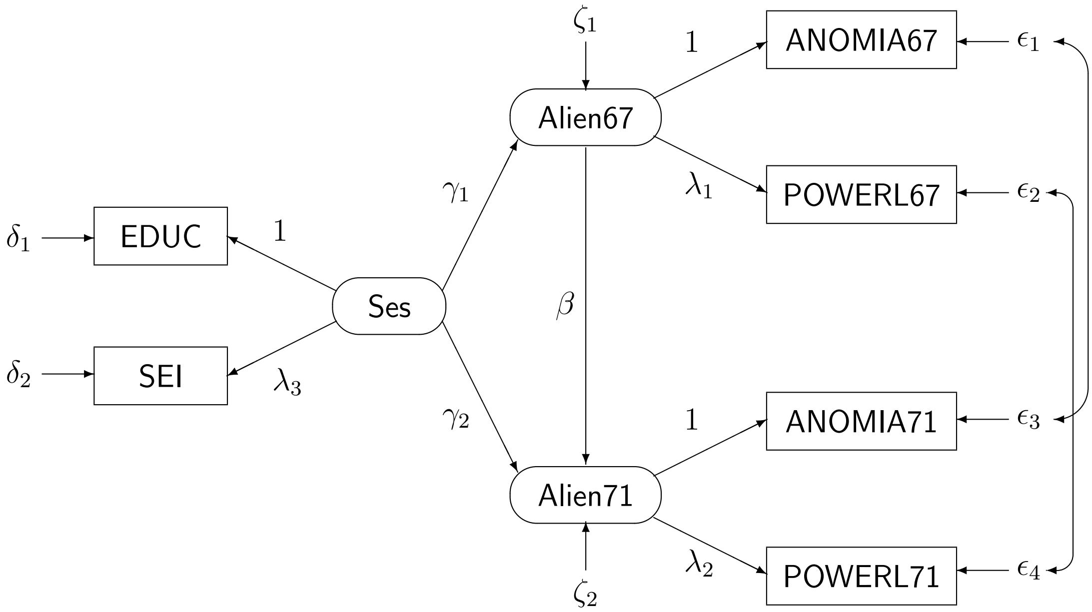

Figure 1.1. A Stability of Alienation model

LISREL

LInear Structural RELations

Integration of structural and measurement model

A structural model with measurement errors

Karl Jöreskog & Dag Sörbom

The LISREL Model

1. Structural model for latent variables

$$\boldsymbol{\eta} = \mathbf{B}\boldsymbol{\eta} + \boldsymbol{\Gamma}\boldsymbol{\xi} + \boldsymbol{\zeta}$$

2. Measurement model for **y**-variables

$$\mathbf{y} = \boldsymbol{\Lambda}_y\boldsymbol{\eta} + \boldsymbol{\epsilon}$$

3. Measurement model for **x**-variables

$$\mathbf{x} = \boldsymbol{\Lambda}_x\boldsymbol{\xi} + \boldsymbol{\delta}$$

Example Input File

```
[Title]
   ---
Observed Variables [from File filename]
   ---
Covariance Matrix [from File filename]
   ---
Sample Size

[Latent Variables [from File filename]]
   ---
Relationships
   ---
[Method = Generalized Least Squares]
[Number of Decimals = 3]
[Options: [RS WP AD=OFF]]
[LISREL Output]
[Path Diagram]

End of Problem
```

Stability of Alienation Model

SIMPLIS Input File

```
Observed Variables
   ANOMIA67 POWERL67 ANOMIA71 POWERL71 EDUC SEI

Covariance Matrix from File EX06.COV

Sample Size 932

Latent Variables
   Alien67 Alien71 Ses

Paths
   Alien67 -> ANOMIA67  POWERL67
   Alien71 -> ANOMIA71  POWERL71
   Ses     -> EDUC  SEI
   Alien67 -> Alien71
   Ses     -> Alien67  Alien71

Let Errors ANOMIA67 ANOMIA71 Correlate
Let Errors POWERL67 POWERL71 Correlate

End of Problem
```

Title

Title of model under study

Examples

```
Title
  Stability of Alienation
   - Model D: Correlated Errors
   - Standardized Solution
```

```
STAL -- Model D: Correlated Errors
```

Notice

– `Title Stability of Alienation` (no analysis)

– `Observed Variables` or `Labels` (end Title)

– Possibilities for stacked input

– Multi-sample models (multiple groups)

Observed Variables or Labels

Labels of observed variables in the model

Examples

```
Observed Variables
   ANOMIA67 POWERL67 ANOMIA71 POWERL71 EDUC SEI
```

```
Observed Variables: Var1 - Var6
```

```
Observed Variables from File filename
```

```
Labels from File filename
```

Notice

– Header lines `Observed Variables` and `Labels` are synonymous

– Number and order of variables is set

– `File =` *filename* is also permitted

Sample Data

Options

– Raw Data
– Covariance Matrix
– Covariance Matrix and Means
– Correlation Matrix
– Correlation Matrix and Standard Deviations
– Correlation Matrix, Standard Deviations, and Means

Examples

```
Covariance Matrix
   11.834
    6.947  9.364
    6.819  5.091 12.532
    4.783  5.028  7.495  9.986
   -3.839 -3.889 -3.841 -3.625  9.610
   -2.190 -1.883 -2.175 -1.878  3.552  4.503

Covariance Matrix from File EX06.COV

Raw Data from File EX06.RAW
```

Sample Data

Notice

– Asymptotic Covariance Matrix (`ACOV`)
– Asymptotic Variances (`AVAR`)
– Free format (comma, blank, <CR>)
– `FORTRAN` format, for example `(6D13.6)`
– Missing data; PRELIS
– Ordinal or non-normal data; PRELIS

More examples

`Means from File` *filename*

`Standard Deviations from File` *filename*

`Asymptotic Covariances from File` *filename*

`Asymptotic Variances from File` *filename*

Sample Size

Number of observations in raw data matrix $\mathbf{X}$

Number of observations on which sample covariance matrix $\mathbf{S}$, or sample correlation matrix $\mathbf{R}$, is based

Examples

```
Sample Size 932
```

```
Sample Size
  932
```

```
Sample Size = 932
```

Latent Variables or Unobserved Variables

Labels of latent variables in the model

Examples

```
Latent Variables: Alien67  Alien71  Ses

Latent Variables
  Alien67  Alien71  Ses

Unobserved Variables
  Alien67  Alien71  Ses
```

Notice

– Header lines `Latent Variables`
  and `Unobserved Variables` are synonymous

– Do not use the same labels as for `Observed Variables`

Syntax

```
Relationships
```

dependent *varlist* = independent *varlist*

```
Relationships
```

response *varlist* = explanatory *varlist*

Example

```
Relationships
   ANOMIA67 POWERL67 = Alien67
   ANOMIA71 POWERL71 = Alien71
   EDUC SEI = Ses
   Alien67 = Ses
   Alien71 = Alien67 Ses
```

Notice

– Header lines `Relationships`, `Relations`, and `Equations` are synonymous

– In specifying relationships, separate structural latent variable and measurement part!

Paths

Specify relationships in terms of paths

Syntax

varlist `->` *varlist*

That is, `FROM` *varlist* `TO` *varlist*

Example

```
Paths
   Alien67 -> ANOMIA67 POWERL67
   Alien71 -> ANOMIA71 POWERL71
   Ses     -> EDUC SEI
   Alien67 -> Alien71
   Ses     -> Alien67 Alien71
```

Notice

– The 'direction' of `Paths` (`FROM -> TO`) is reverse to that of `Relationships` (cf. regression equation)

– In specifying paths, separate structural latent variable and measurement part!

Scaling of Latent Variables

Origin and units of measurement of latent variables
are arbitrary, and have to be defined

Origin: Assume zero mean

Unit of measurement: Two options

1. Direct standardization

Assume that they are standardized,
i.e., have variance of one in the population

Unit of measurement of latent variable
equals population standard deviation

For both Eta ($\boldsymbol{\eta}$) and for Ksi ($\boldsymbol{\xi}$), i.e.,
for both response and explanatory latent variables

Result: Standardized Solution (`SS`)

Standardized Solution by default,
if the second option is not chosen

2. Indirect standardization

Fix a non-zero coefficient (usually to `1`)
in the relationship for one of the observed
indicators of a latent variable

Unit of measurement of latent variable is
related to one of the observed variables,
the so-called `reference variable`

`Standardized Solution` can also be obtained
now by putting `SS` or `SC` on the LISREL `OU`-line

Example

```
Relations
   ANOMIA67 = 1*Alien67
   POWERL67 = Alien67
   ANOMIA71 = 1*Alien71
   POWERL71 = Alien71
   EDUC     = 1*Ses
   SEI      = Ses
```

Notice

This *cannot* be done with `Paths` statements

Usually generated by LISREL itself

If a good estimate of parameter θ is a priori available, it is possible to specify so

Put starting value of a parameter
in parentheses followed by an asterisk $*$
and then the name of a variable in a relationship

Example

```
Relations
   POWERL71 = (.90)*Alien71
```

Notice

Difference between coefficients used for fixing parameters (`ANOMIA71 = 1*Alien71`), and coefficients used as starting values for parameter estimation

Error Variances and Covariances

Distinguish

– Measurement errors in observed $\mathbf{x}$-variables
– Measurement errors in observed $\mathbf{y}$-variables
– Structural errors in structural $\boldsymbol{\eta}$-equations

That is, errors in $\mathbf{x}$, $\mathbf{y}$, and $\boldsymbol{\eta}$-equations, resp.

1. Fixed Error Variances

By default, variances of all error terms
are free parameters to be estimated

Fix them as follows:

a. `Let the Error Variance of` *varlist* `be c`
b. `Set the Error Variance of` *varlist* `to c`

Example

```
Let Error Variance EDUC be 0
```

2. Error Covariances

Possibilities of correlated errors

– between two **x**-variables

– between two **y**-variables

– between an **x**- and a **y**-variable

– between two $\boldsymbol{\eta}$-variables

Default: all error terms uncorrelated

Specify (un)correlated errors as follows:

a. `Let the Errors of` *varlist* `and` *varlist* `Correlate`

b. `Set the Error Covariances between` *varlist* `and` *varlist* `Free`

c. `Set the Error Covariances between` *varlist* `and` *varlist* `to 0`

Example

```
Let Errors ANOMIA67 ANOMIA71 Correlate
Let Errors POWERL67 POWERL71 Correlate
```

Uncorrelated Factors

By default, the explanatory latent variables (ξ- or Ksi-variables) are freely correlated

That is, correlated or oblique factors

If explanatory latent variables should be uncorrelated (i.e., orthogonal factors), this can be done as follows:

a. `Set the Covariances of` *Ksi-varlist* `to 0`

b. `Set the Correlations of` *Ksi-varlist* `to 0`

Example

```
Set Correlations Ksi1 - Ksi3 to 0
```

1. Equal Paths

A path coefficient (or parameter) can be specified to equal another path coefficient

This amounts to estimating one single free parameter rather than two 'independent' ones

This can be done as follows:

a. `Set Path from VarA to VarB equal to Path from VarC to VarD`
b. `Set Path VarA -> VarB = Path VarC -> VarD`
c. `Set VarA -> VarB = VarC -> VarD`
d. `Let VarA -> VarB = VarC -> VarD`

Example

```
Let Alien67 -> POWERL67 = Alien71 -> POWERL71
```

2. Equal Error Variances

Two or more error variances can be specified to be equal, as follows:

a. `Set the Error Variances of` *varlist* `Equal`

b. `Let Error Variances of` *varlist* `be Equal`

c. `Equal Error Variances:` *varlist*

Example

```
Equal Error Variances: ANOMIA67 ANOMIA71
Equal Error Variances POWERL67 POWERL71
```

Freeing a Fixed Parameter, or Relaxing an Equality Constraint

Needed in multi-sample, or multi-group models

There, all model parameters are constrained
to be equal across groups, unless specified otherwise

Fixed or constrained parameters can be set
free under header line `Paths` or `Relationships`

Example

If path `VarA -> VarB` is fixed or constrained,
it can be freed in two ways:

```
Paths: VarA -> VarB
```

```
Relationships: VarB = VarA
```

Options

Refers to printing the output file, and the request for additional information in that file

Some examples of possible options are:

– `Wide Print`	`WP`
– `Print Residuals`	`RS`
– `Number of Decimals = 3`	`ND=3`
– `Method of Estimation = GLS`	`ME=GLS`
– `Admissibility Check = Off`	`AD=OFF`
– `Iterations = 50`	`IT=50`
– `Save Sigma in File` *filename*	`SI=` *filename*

Example

`Options:  RS ND=3 ME=GLS AD=OFF IT=50 SI=` *filename*

1. Wide Print or `WP`

Default 80; maximum 132 characters per line

View: `Path diagram`; key D

`DISP` *output_filename*

Examples

```
Wide Print 100
Options: WP=100
```

2. Print Residuals or `RS`

Fitted and standardized residuals (matrices)
QQ-plot of standardized residuals
Fitted covariance or correlation matrix

Examples

```
Print Residuals
Options: RS
```

3. Number of Decimals or `ND`

Default `ND=2`

Printed # decimals depends on # significant digits $< n$

Examples

```
Number of Decimals 5
Options: ND=5
```

4. Method of Estimation or `ME`

Available methods

– Instrumental Variables (`IV`)
– Two-Stage Least Squares (`TSLS, TS`)
– Unweighted Least Squares (`ULS, UL`)
– Generalized Least Squares (`GLS, GL`)
– Maximum Likelihood (`ML`)
– Generally Weighted Least Squares (`WLS, WL`)
– Diagonally Weighted Least Squares (`DWLS, DW`)

4. Method of Estimation or `ME`

Notice

- `IV` and `TSLS`: non-iterative and fast
- `WLS` requires estimate of asymptotic covariance matrix of sample covariances, or correlations (`ACOV`)
- `DWLS` requires estimate of asymptotic variances of sample variances, or correlations (`AVAR`)
- Estimate `ACOV` and `AVAR` with PRELIS
- If no `ACOV` or `AVAR`, then `ML` (default)
- If `ACOV`, then `WLS` (default)
- If `AVAR`, then `DWLS` (default)

Examples

```
Method : Two-Stage Least Squares
Options: TS                    ! [STAL example: bug!]
Options: ME=GLS
```

5. Admissibility Check or `AD`

– Matrices $\mathbf{\Lambda}_x$ and $\mathbf{\Lambda}_y$ have full column rank,
and no rows with only zeros

– All covariance matrices $\mathbf{\Phi} = E(\boldsymbol{\xi}\boldsymbol{\xi}')$, $\mathbf{\Psi} = E(\boldsymbol{\zeta}\boldsymbol{\zeta}')$,
$\mathbf{\Theta}_\epsilon = E(\boldsymbol{\epsilon}\boldsymbol{\epsilon}')$, and $\mathbf{\Theta}_\delta = E(\boldsymbol{\delta}\boldsymbol{\delta}')$ are positive definite

If, after 20 iterations (by default)
the solution is inadmissible, the iteration process stops

Examples

```
Admissibility Check 40
Options: AD=40
Admissibility Check OFF     ! usually not recommended
Options: AD=OFF
```

6. Maximum Number of Iterations

Default: three times # independent
parameters to be estimated in a model

Examples

```
Iterations 100
Options: IT=100
```

7. Save Sigma

The fitted, or model-implied covariance matrix $\hat{\boldsymbol{\Sigma}}$
can be saved to file

Examples

```
Save Sigma in File SIGMA_D
Options: SI=SIGMA_D
```

Bias-corrected single-sample cross-validation index of Browne and Cudeck (1989) can be calculated:

$$\text{CVI} = F(\mathbf{S}_v, \hat{\mathbf{\Sigma}}_{c,j}) - \frac{k(k+1)}{2n_v}$$

F	:	discrepancy or fit function
$\mathbf{S}_v$	:	covariance matrix of validation sample
$\hat{\mathbf{\Sigma}}_{c,j}$	:	implied covariance matrix fitted in calibration or exploration sample under Model j
k	:	number of observed variables
n_v	:	sample size in validation sample

Example

In two separate analyses (not in one!)

1. `Save Sigma in File SIGMA_D`
2. `Crossvalidate File SIGMA_D`

Cross-validation

Notice

– Output: cross-validation index CVI, and
  90% confidence interval for population CVI
  — cf. Browne (1990), Browne & Cudeck (1989, 1992)

– Bad treatment and example of Jöreskog & Sörbom (1996a, p. 183)

  - Comparison with ECVI (p. 119)
  - `Sample Size` header missing
  - Suspect computation: negative CVI value

– Boomsma (2003) provides extensive treatment for LISREL applications

LISREL Output

Distinguish

– SIMPLIS Output: estimated model
  presented in equation form (default)
  Estimates, `SE, TV, FIT, RS` summary

– LISREL Output: estimated model
  presented in matrix form
  (with, or without additional information)

Examples

```
LISREL Output
LISREL Output ALL          [missing MI occurs]
LISREL Output: SS SC EF RS VA FS PC PT
```

`SS`	Standardized solution
`SC`	Completely standardized solution
`EF`	Total and indirect effects, their standard errors, and t-values
`RS`	Residuals
`VA`	Variances and covariances of latent variables
`FS`	Factor scores regression
`PC`	Correlations of parameter estimates
`PT`	Technical information
`MI`	Modification index

STABILITY OF ALIENATION MODEL

SIMPLIS OUTPUT FILE

```
The following lines were read from file EX06d.sim:

Stability of Alienation - Model D: Correlated Errors
                        - Standardized Solution

Observed Variables
  ANOMIA67   POWERL67   ANOMIA71   POWERL71   EDUC  SEI
Covariance Matrix
  11.834
   6.947      9.364
   6.819      5.091     12.532
   4.783      5.028      7.495      9.986
  -3.839     -3.889     -3.841     -3.625      9.610
  -2.190     -1.883     -2.175     -1.878      3.552    4.503
Sample Size 932
Latent Variables  Alien67  Alien71  Ses

Paths
  Alien67 -> ANOMIA67  POWERL67
  Alien71 -> ANOMIA71  POWERL71
  Ses     -> EDUC  SEI
  Alien67 -> Alien71
  Ses     -> Alien67  Alien71

Let the Errors of ANOMIA67 and ANOMIA71 Correlate
Let the Errors of POWERL67 and POWERL71 Correlate

Print Residuals
Path Diagram
End of Problem

Sample Size =   932

Stability of Alienation - Model D: Correlated Errors
```

COVARIANCE MATRIX TO BE ANALYZED

	ANOMIA67	POWERL67	ANOMIA71	POWERL71	EDUC	SEI
ANOMIA67	11.83					
POWERL67	6.95	9.36				
ANOMIA71	6.82	5.09	12.53			
POWERL71	4.78	5.03	7.50	9.99		
EDUC	-3.84	-3.89	-3.84	-3.63	9.61	
SEI	-2.19	-1.88	-2.17	-1.88	3.55	4.50

```
Number of Iterations = 22


LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

ANOMIA67 = 2.66*Alien67, Errorvar.= 4.74 , R2 = 0.60
          (0.13)                  (0.45)
           20.71                   10.43

POWERL67 = 2.61*Alien67, Errorvar.= 2.57 , R2 = 0.73
          (0.13)                  (0.40)
           20.02                   6.36

ANOMIA71 = 2.85*Alien71, Errorvar.= 4.40 , R2 = 0.65
          (0.14)                  (0.52)
           20.20                   8.54

POWERL71 = 2.63*Alien71, Errorvar.= 3.07 , R2 = 0.69
          (0.13)                  (0.43)
           20.19                   7.07

    EDUC = 2.61*Ses, Errorvar.= 2.81 , R2 = 0.71
          (0.12)              (0.51)
           20.94               5.52

     SEI = 1.36*Ses, Errorvar.= 2.65 , R2 = 0.41
          (0.079)             (0.18)
           17.22               14.59

Error Covariance for ANOMIA71 and ANOMIA67 = 1.62
                                            (0.31)
                                             5.17
Error Covariance for POWERL71 and POWERL67 = 0.34
                                            (0.26)
                                             1.30

 Alien67 =  - 0.56*Ses, Errorvar.= 0.68, R2 = 0.32
             (0.051)
             -11.11

 Alien71 = 0.57*Alien67 - 0.21*Ses, Errorvar.= 0.50, R2 = 0.50
          (0.055)       (0.046)
           10.27        -4.51

        CORRELATION MATRIX OF INDEPENDENT VARIABLES

                Ses
           --------
               1.00
```

```
         COVARIANCE MATRIX OF LATENT VARIABLES

               Alien67    Alien71        Ses
              --------   --------   --------
   Alien67       1.00
   Alien71       0.68       1.00
       Ses      -0.56      -0.53       1.00


                       GOODNESS OF FIT STATISTICS

          CHI-SQUARE WITH 4 DEGREES OF FREEDOM = 4.73 (P = 0.32)
             ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 0.73
         90 PERCENT CONFIDENCE INTERVAL FOR NCP = (0.0 ; 10.53)

                    MINIMUM FIT FUNCTION VALUE = 0.0051
           POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.00079
          90 PERCENT CONFIDENCE INTERVAL FOR F0 = (0.0 ; 0.011)
         ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.014
         90 PERCENT CONFIDENCE INTERVAL FOR RMSEA = (0.0 ; 0.053)
           P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.93

              EXPECTED CROSS-VALIDATION INDEX (ECVI) = 0.042
        90 PERCENT CONFIDENCE INTERVAL FOR ECVI = (0.041 ; 0.052)
                     ECVI FOR SATURATED MODEL = 0.045
                    ECVI FOR INDEPENDENCE MODEL = 2.30

                     CHI-SQUARE FOR INDEPENDENCE MODEL
                   WITH 15 DEGREES OF FREEDOM = 2131.40
                        INDEPENDENCE AIC = 2143.40
                            MODEL AIC = 38.73
                          SATURATED AIC = 42.00
                       INDEPENDENCE CAIC = 2178.42
                           MODEL CAIC = 137.97
                         SATURATED CAIC = 164.58

                 ROOT MEAN SQUARE RESIDUAL (RMR) = 0.057
                        STANDARDIZED RMR = 0.0074
                    GOODNESS OF FIT INDEX (GFI) = 1.00
             ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.99
            PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.19

                      NORMED FIT INDEX (NFI) = 1.00
                    NON-NORMED FIT INDEX (NNFI) = 1.00
                 PARSIMONY NORMED FIT INDEX (PNFI) = 0.27
                    COMPARATIVE FIT INDEX (CFI) = 1.00
                     INCREMENTAL FIT INDEX (IFI) = 1.00
                      RELATIVE FIT INDEX (RFI) = 0.99

                        CRITICAL N (CN) = 2611.90
```

```
        FITTED COVARIANCE MATRIX

           ANOMIA67  POWERL67  ANOMIA71  POWERL71      EDUC       SEI
           --------  --------  --------  --------  --------  --------
 ANOMIA67     11.83
 POWERL67      6.95      9.36
 ANOMIA71      6.82      5.08     12.53
 POWERL71      4.79      5.03      7.50      9.99
     EDUC     -3.91     -3.83     -3.92     -3.61      9.61
      SEI     -2.04     -2.00     -2.05     -1.89      3.55      4.50

        FITTED RESIDUALS

           ANOMIA67  POWERL67  ANOMIA71  POWERL71      EDUC       SEI
           --------  --------  --------  --------  --------  --------
 ANOMIA67      0.00
 POWERL67      0.00      0.00
 ANOMIA71      0.00      0.01      0.00
 POWERL71     -0.01      0.00      0.00      0.00
     EDUC      0.07     -0.06      0.08     -0.01      0.00
      SEI     -0.15      0.12     -0.13      0.01      0.00      0.00

 SUMMARY STATISTICS FOR FITTED RESIDUALS
 SMALLEST FITTED RESIDUAL =   -0.15
   MEDIAN FITTED RESIDUAL =    0.00
  LARGEST FITTED RESIDUAL =    0.12

        STANDARDIZED RESIDUALS

           ANOMIA67  POWERL67  ANOMIA71  POWERL71      EDUC       SEI
           --------  --------  --------  --------  --------  --------
 ANOMIA67      0.00
 POWERL67      0.09      0.00
 ANOMIA71     -0.09      0.09      0.00
 POWERL71     -0.09      0.09     -0.09      0.00
     EDUC      0.92     -1.01      0.98     -0.15      0.00
      SEI     -1.43      1.58     -1.18      0.09      0.00      0.00

 SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
 SMALLEST STANDARDIZED RESIDUAL =   -1.43
   MEDIAN STANDARDIZED RESIDUAL =    0.00
  LARGEST STANDARDIZED RESIDUAL =    1.58

 STEMLEAF PLOT
 - 1|420
 - 0|21110000000
   0|11119
   1|06
```

Path Diagram

With LISREL and SIMPLIS path diagrams
on the screen, and to the printer

Looking at the screen for information
about the model in path diagrams

Model modification in path diagrams
at run time, by adding or deleting
paths in the diagram

Statistical pitfalls; cross-validation

See Chapter 3 of SIMPLIS manual
Jöreskog & Sörbom (1996a)

Changing significance levels

1. for t-values; default 5.0%, i.e., t-value 1.96

2. for modification indices; default 0.5%,
   i.e., MI-value 7.88

Syntax

`Path Diagram TV=`$n\%$ `MI=`$n\%$

Example

```
Path Diagram TV=1 MI=10
```

Notice

Put header `Path Diagram` after `Observed Variables`, and before `End of Problem`

Path Diagram

Saving path diagrams

- All graphical information in `ASCII` file *input_filename* `.PDM`
- To produce path diagrams execute program `PATHDIAG` *input_filename*
- `PATHDIAG` only for viewing and printing, not for model modification

Example

```
PATHDIAG EX06D1
```

Stability of Alienation Model
Path Diagram of Basic Model

Below, the basic model display of the LISREL `Path Diagram` option is shown

The numbers refer to the maximum likelihood estimates of model parameters associated with the paths

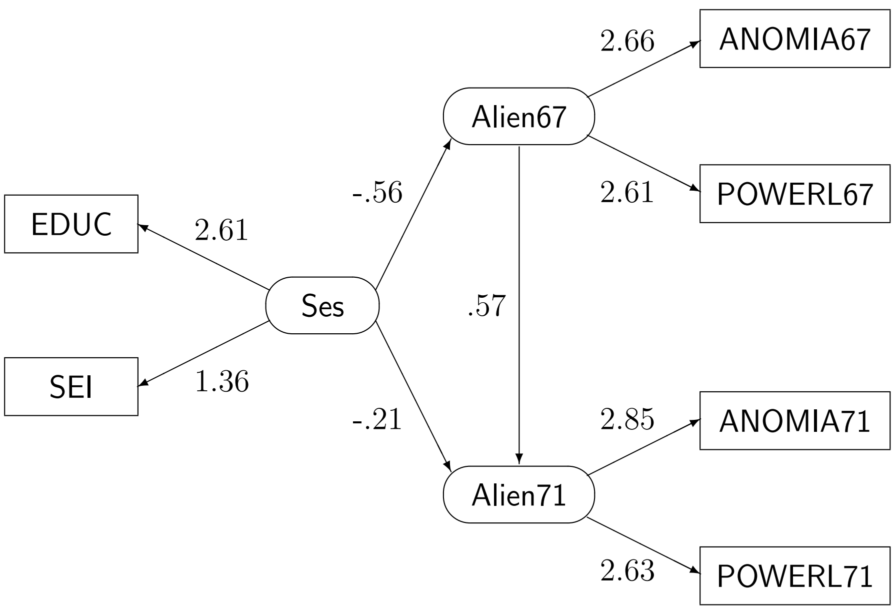

Figure 1.2. Parameter Estimates of Stability of Alienation Model

End of Problem

Optional in theory; in practice not

For multiple models stacked together

For multi-sample problems, only after the last group

Example

```
End of Problem
```