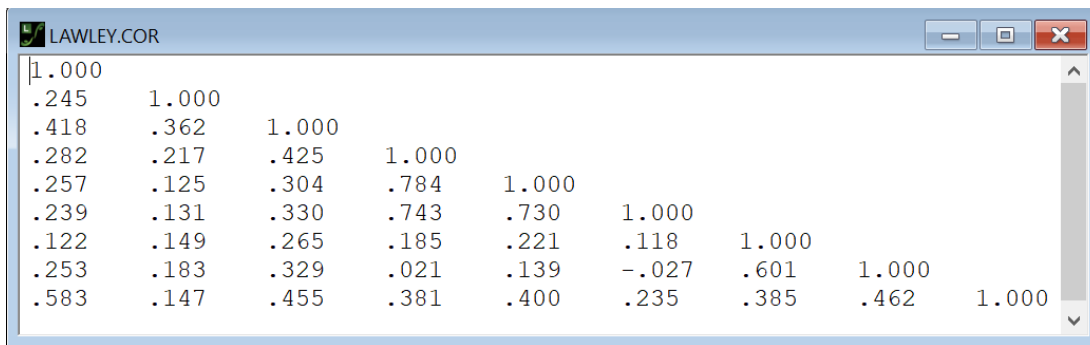


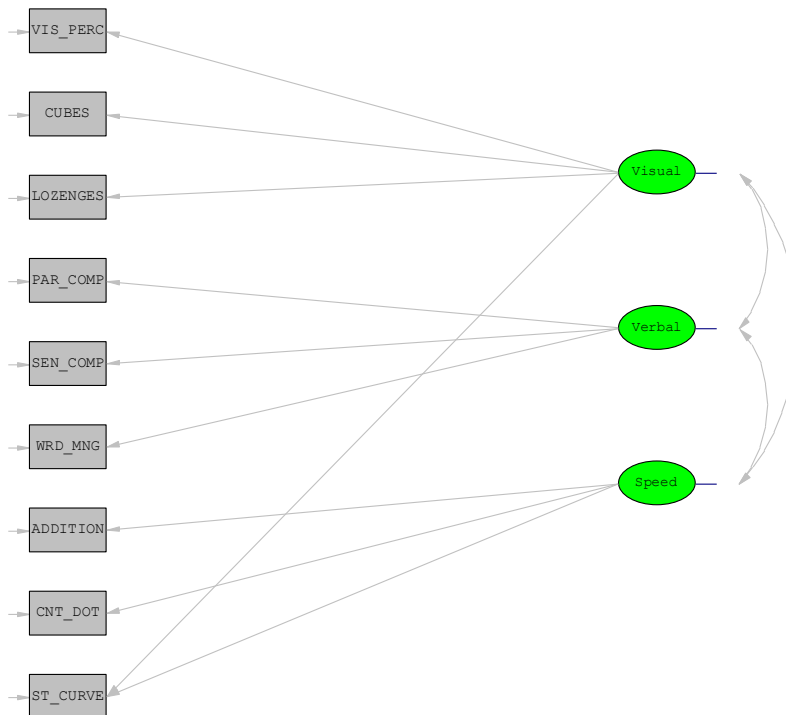
Standard errors for standardized solutions using ability test data

The data are the scores of 72 students on nine mental ability tests (visual perception, cubes, lozenges, paragraph completion, sentence completion, word meaning, addition, counting dots, and structured curves) used by Lawley and Maxwell (1971). The corresponding correlation matrix file is **LAWLEY.COR** which is shown below.



1.000								
.245	1.000							
.418	.362	1.000						
.282	.217	.425	1.000					
.257	.125	.304	.784	1.000				
.239	.131	.330	.743	.730	1.000			
.122	.149	.265	.185	.221	.118	1.000		
.253	.183	.329	.021	.139	-.027	.601	1.000	
.583	.147	.455	.381	.400	.235	.385	.462	1.000

The theoretical model is a confirmatory factor analysis model that specifies that the nine psychological tests are indicators of visual ability, verbal ability, and speed of students. A path diagram for this model is depicted in the image below.



The LISREL syntax file for the theoretical model above is shown in the image below.

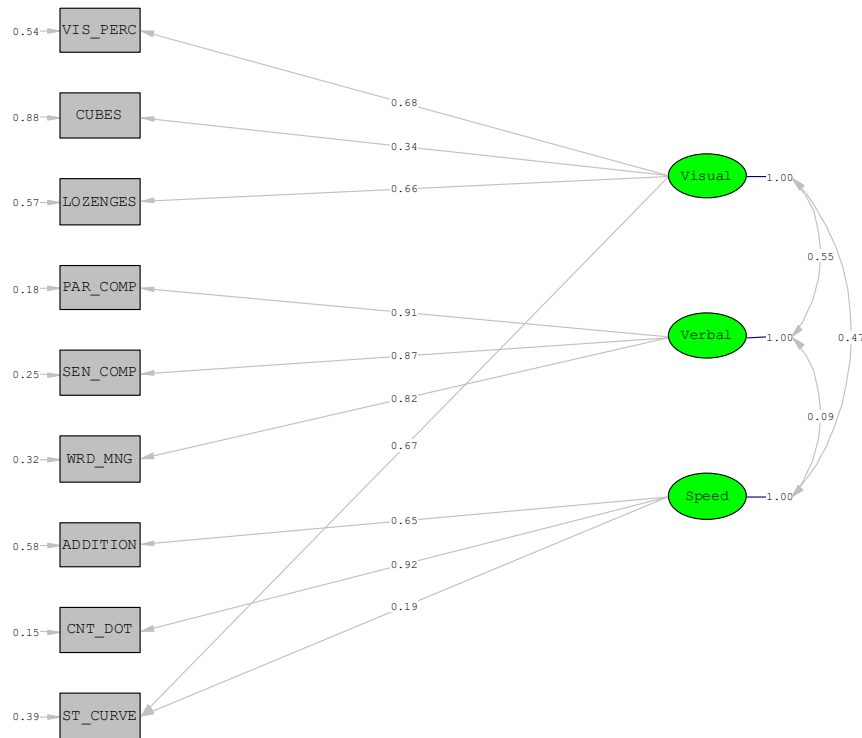
```

LAWLEY.lis
DA NI=9 NO=72 MA=KM
LA
VIS_PERC CUBES LOZENGES PAR_COMP SEN_COMP WRD_MNG
ADDITION CNT_DOT ST_CURVE
KM=LAWLEY.COR
MO NX=9 NK=3 PH=ST
LK
Visual Verbal Speed
FR LX 1 1 LX 2 1 LX 3 1 LX 4 2 LX 5 2 LX 6 2
FR LX 7 3 LX 8 3 LX 9 1 LX 9 3
PD
OU SC

```

- Line 1 specifies the number of observed variables, the number of observations, and that the model is to be fitted to the sample correlation matrix.
- Lines 2 to 4 specify the labels for the observed variables of the model.
- Line 5 specifies the correlation matrix file.
- Line 6 specifies the number of indicators, the number of exogenous latent variables, and the correlation matrix of the exogenous latent variables.
- Lines 7 to 8 specify the labels for the exogenous latent variables.
- Line 9 to 10 specify the free factor loadings for the exogenous latent variables.
- Line 11 requests a path diagram of the model.
- Line 12 requests the standardized and completely standardized solutions.

If this LIS file is opened in LISREL and the **Run LISREL** icon is clicked, the following path diagram is obtained.



The corresponding output file, **LAWLEY.OUT**, is opened in a separate window. The completely standardized estimates, the standard error estimates, the test statistic values, and the exceedance probabilities for the free parameters of the model, which are listed in this file, are shown in the images below.

The screenshot shows a window titled "LAWLEY.OUT" with a standard Windows interface (minimize, maximize, close buttons). The content is a text-based table titled "Completely Standardized Solution". The table has three columns: "Visual", "Verbal", and "Speed", each with a dashed line underneath. The rows list parameters and their standardized estimates, standard errors in parentheses, and test statistics. The parameters are: VIS_PERC, CUBES, LOZENGES, PAR_COMP, SEN_COMP, WRD_MNG, ADDITION, CNT_DOT, and ST_CURVE. The test statistics are located to the right of the parameter names.

	Visual	Verbal	Speed	
VIS_PERC	0.679 (0.086) 7.868	- -	- -	
CUBES	0.341 (0.121) 2.827	- -	- -	
LOZENGES	0.659 (0.089) 7.442	- -	- -	
PAR_COMP	- -	0.908 (0.036) 25.520	- -	
SEN_COMP	- -	0.867 (0.041) 21.413	- -	
WRD_MNG	- -	0.824 (0.047) 17.656	- -	
ADDITION	- -	- -	0.651 (0.103) 6.290	
CNT_DOT	- -	- -	0.924 (0.111) 8.296	
ST_CURVE	0.670 (0.113) 5.957	- -	0.192 (0.129) 1.483	

LAWLEY.OUT

```

      PHI
      -----
      Visual      Verbal      Speed
      -----
Visual      1.000
Verbal      0.552      1.000
            (0.111)
            4.974
Speed      0.474      0.088      1.000
            (0.143)      (0.133)
            3.324      0.661

      THETA-DELTA
      -----
      VIS_PERC      CUBES      LOZENGES      PAR_COMP      SEN_COMP      WRD_MNG
      -----
            0.538      0.884      0.566      0.175      0.248      0.321
            (0.117)      (0.082)      (0.117)      (0.065)      (0.070)      (0.077)
            4.587      10.739      4.854      2.715      3.525      4.170

      THETA-DELTA
      -----
      ADDITION      CNT_DOT      ST_CURVE
      -----
            0.577      0.146      0.392
            (0.135)      (0.206)      (0.107)
            4.286      0.707      3.655

```

The estimates and standard error estimates listed above agree with those reported in Table 7.10 of page 102 of Lawley and Maxwell (1971).

References

Lawley, D.N. & Maxwell, A.E. (1971). *Factor analysis as a statistical method (second edition)*. New York: American Elsevier.