SPSS MANOVA

The following SPSS code performs a MANOVA on three difference scores (post-pre) in the Kurlu data set. The CONTRAST statement in SPSS is a diabolical attempt to confuse everybody from the beginning student to the astute statistician. When one performs a contrast in SPSS, there must always be as many rows to the matrix as there are levels in the ANOVA factor. The first row should always be a row of 1s. The remaining rows (the second, third, and fourth in this case), give the substantive contrasts. Be very careful because the CONTRAST statement in other SPSS procedures works differently.

The TRANSFORM statement follows a similar logic. There must always be as many rows to the transformation matrix as there are dependent variables to be transformed. The TRANSFORM statement does not appear in point-and-click SPSS. It must be entered by hand into the Syntax window. Also, note that when a transformation is done, SPSS does not perform the MANOVA or individual ANOVAs on the original variables. It only does it for the transformed variables.

The MANOVA is actually performed by using the PRINT statement. Below, the PRINT statement requests the parameter estimates [PARAM(ESTIM)]; both multivariate and univariate tests of significance [SIGNIF(MULT UNIV)]; test of the homogeneity of variance-covariance matrices within groups [HOMOGENEITY(BARTLETT COCHRAN BOXM)]; and the pooled correlation matrix within groups [ERROR(CORR)].

The CINTERVAL statement calculates and prints confidence intervals (95% C.I.s, in this case) and uses simple univariate tests to determine significance levels for the means. The ERROR matrix specifies which error term to use, and the DESIGN statement gives the design to be analyzed. You can use more than one DESIGN statement. For example, one could test for main effects only and the second for both main effects and interactions.

```spss
* MANOVA
MANOVA si_impr sf_impr oi_impr BY group(1 4)
/CONTRAST (group) = special( 1 1 1 1,
-3 1 1 1,
0 -2 1 1,
0 0 -1 1)
/TRANSFORM (si_impr sf_impr oi_impr) = special (1 1 1,
1 -1 0,
0 1 -1)
/PRINT PARAM(ESTIM) SIGNIF(MULT UNIV )
HOMOGENEITY(BARTLETT COCHRAN BOXM)
ERROR(CORR)
/CINTERVAL INDIVIDUAL(.95) UNIVARIATE
/METHOD=UNIQUE
/ERROR WITHIN+RESIDUAL
/DESIGN .
```
* * * * * Analysis of Variance * * * * *

40 cases accepted.
0 cases rejected because of out-of-range factor values.
0 cases rejected because of missing data.
4 non-empty cells.

1 design will be processed.

<table>
<thead>
<tr>
<th>CELL NUMBER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>GROUP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following section of code tests for the homogeneity of variance for the three transformed variables (T1 = Level, T2 = si_impr - sf_impr, and T3 = sf_impr - oi_impr). Why it does not give tests for homogeneity of variance for the original three variables (si_impr, sf_impr, oi_impr) is a mystery.

Univariate Homogeneity of Variance Tests

Variable .. T1
   Cochrans C(9,4) =  .42314, P = .219 (approx.)
   Bartlett-Box F(3,2333) =  .88552, P = .448

Variable .. T2
   Cochrans C(9,4) =  .46225, P = .110 (approx.)
   Bartlett-Box F(3,2333) =  1.46240, P = .223

Variable .. T3
   Cochrans C(9,4) =  .29263, P = 1.000 (approx.)
   Bartlett-Box F(3,2333) =  .15506, P = .926

This section of output begins the tests for the homogeneity of the variance-covariance matrix. It begins by printing out the determinants and the log of the determinants for the covariance matrix for each cell in the ANOVA factor. These are very exciting numbers for some people, who often spend countless hours at TGIF parties discussing them.

Cell Number .. 1
Determinant of Covariance matrix of dependent variables =  194713.39808
LOG(Determinant) =  12.17928

Cell Number .. 2
Determinant of Covariance matrix of dependent variables =  185969.38642
LOG(Determinant) =  12.13334
Cell Number .. 3

Determinant of Covariance matrix of dependent variables = 57582.90754
LOG(Determinant) = 10.96098

Cell Number .. 4

Determinant of Covariance matrix of dependent variables = 101439.35802
LOG(Determinant) = 11.52722

Determinant of pooled Covariance matrix of dependent vars. = 173813.31265
LOG(Determinant) = 12.06574

These are the actual tests for the homogeneity of the covariance matrices within groups. A perverted programmer decided to call these “Dispersion” matrices to continue the confusion.

Multivariate test for Homogeneity of Dispersion matrices

Boxs M = 13.15917
F WITH (18,4579) DF = .61819, P = .889 (Approx.)
Chi-Square with 18 DF = 11.17920, P = .887 (Approx.)

WITHIN+RESIDUAL Correlations with Std. Devs. on Diagonal

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>19.772</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>-.041</td>
<td>8.651</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>.216</td>
<td>-.598</td>
<td>9.405</td>
</tr>
</tbody>
</table>

Statistics for WITHIN+RESIDUAL correlations
Log(Determinant) = -.50346
Bartlett test of sphericity = 17.20161 with 3 D. F.
Significance = .001
F(max) criterion = 5.22359 with (3,36) D. F.

NOTE WELL: The following is the MANOVA for the transformed variables. If you want the MANOVA for the original variables, get rid of the TRANSFORM statement and rerun the program.

* * * Analysis of Variance -- design 1 * * * * * *

EFFECT .. GROUP
Multivariate Tests of Significance (S = 3, M = -1/2, N = 16)

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Value</th>
<th>Approx. F</th>
<th>Hypoth. DF</th>
<th>Error DF</th>
<th>Sig. of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pillais</td>
<td>.63123</td>
<td>3.19776</td>
<td>9.00</td>
<td>108.00</td>
<td>.002</td>
</tr>
<tr>
<td>Hotellings</td>
<td>.94953</td>
<td>3.44644</td>
<td>9.00</td>
<td>98.00</td>
<td>.001</td>
</tr>
<tr>
<td>Wilks</td>
<td>.46438</td>
<td>3.41257</td>
<td>9.00</td>
<td>82.90</td>
<td>.001</td>
</tr>
<tr>
<td>Roys</td>
<td>.38960</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The univariate statistics for the transformed variables:

EFFECT .. GROUP (Cont.)
Univariate F-tests with (3,36) D. F.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypoth. SS</th>
<th>Error SS</th>
<th>Hypoth. MS</th>
<th>Error MS</th>
<th>F</th>
<th>Sig. of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>5123.00000</td>
<td>14073.4000</td>
<td>1707.66667</td>
<td>390.92778</td>
<td>4.36824</td>
<td>.010</td>
</tr>
<tr>
<td>T2</td>
<td>901.40000</td>
<td>2694.20000</td>
<td>300.46667</td>
<td>74.83889</td>
<td>4.01485</td>
<td>.015</td>
</tr>
<tr>
<td>T3</td>
<td>1205.80000</td>
<td>3184.60000</td>
<td>401.93333</td>
<td>88.46111</td>
<td>4.54362</td>
<td>.008</td>
</tr>
</tbody>
</table>

NOTE EXTRAORDINARILY WELL: The following output gives the results for the CONTRAST, NOT post-hoc tests for the groups. The row labelled 2 gives the test for the second contrast (control group versus the mean of the three experimental groups), the row labelled 3 gives the results of the third contrast (cognitive versus the mean of the behavioral and the abreaction groups), and the row labelled 3 gives the results of the fourth contrast (behavioral versus abreaction). Why the output says Parameter instead of CONTRAST is another diabolical plot to confuse everyone.

Estimates for T1
--- Individual univariate .9500 confidence intervals

GROUP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coeff.</th>
<th>Std. Err.</th>
<th>t-Value</th>
<th>Sig. t</th>
<th>Lower -95%</th>
<th>CL- Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>20.8000000</td>
<td>15.31524</td>
<td>1.35812</td>
<td>.18288</td>
<td>-10.26075</td>
<td>51.86075</td>
</tr>
<tr>
<td>4</td>
<td>2.60000000</td>
<td>8.84226</td>
<td>.29404</td>
<td>.77041</td>
<td>-15.33293</td>
<td>20.53293</td>
</tr>
</tbody>
</table>

Estimates for T2
--- Individual univariate .9500 confidence intervals

GROUP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coeff.</th>
<th>Std. Err.</th>
<th>t-Value</th>
<th>Sig. t</th>
<th>Lower -95%</th>
<th>CL- Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-22.800000</td>
<td>9.47664</td>
<td>-2.40592</td>
<td>.02139</td>
<td>-42.01951</td>
<td>-3.58049</td>
</tr>
<tr>
<td>3</td>
<td>-10.800000</td>
<td>6.70099</td>
<td>-1.61170</td>
<td>.11576</td>
<td>-24.39025</td>
<td>2.79025</td>
</tr>
<tr>
<td>4</td>
<td>-7.4000000</td>
<td>3.86882</td>
<td>-1.91273</td>
<td>.06376</td>
<td>-15.24633</td>
<td>7.83059</td>
</tr>
</tbody>
</table>

Estimates for T3
0 --- Individual univariate .9500 confidence intervals

GROUP

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coeff.</th>
<th>Std. Err.</th>
<th>t-Value</th>
<th>Sig. t</th>
<th>Lower -95%</th>
<th>CL- Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>38.0000000</td>
<td>10.30307</td>
<td>3.68822</td>
<td>.00074</td>
<td>17.10440</td>
<td>58.89560</td>
</tr>
<tr>
<td>3</td>
<td>-.10000000</td>
<td>7.28537</td>
<td>-.01373</td>
<td>.98912</td>
<td>-14.87542</td>
<td>14.67542</td>
</tr>
<tr>
<td>4</td>
<td>-.70000000</td>
<td>4.20621</td>
<td>-.16642</td>
<td>.86876</td>
<td>-9.23059</td>
<td>7.83059</td>
</tr>
</tbody>
</table>