The MANOVA for Independent Groups -- Analysis of 2-Between Group Data with Two or More Quantitative DVs

Application: To compare means of two or more quantitiatve variables obtained from 2 independent groups.

Research Hypothesis: The researcher hypothesized that students who had eaten food that included additives would exhibit greater activity both at school and at home than those students who had not eaten food with additives. (Data taken from Exercise 1, pp. 102-103, Keppel, Saufley & Tokunaga, 1992).

H0: for this analysis: Students who eat food with additives will exhibit the same mean activity levels at school and at home as those who do not eat food with additives

SPSS Code:

```
data list free /  cond   schlact   homeact.
```

There are three values for each student: the IV condition in which they participated and the two DVs that were recorded.

```
variable labels  schlact 'activity level at school - DV'
              / homeact 'activity level at school - DV'
              / cond    'treatment condition  - IV'.

value labels    cond 1 'no additives'  2 'additives'.
```

```
begin data.
1 31 42    2 30 44
1 33 38    2 28 45
1 25 32    2 36 42
1 28 36    2 41 52
1 24 29    2 29 38
1 30 34    2 32 41
1 31 38    2 27 37
1 26 34    2 35 51
1 30 41    2 36 53
end data.

manova schlact homeact by cond (1,2)
     /print cellinfo(means) signif(multiv univ).
```

The data are arranged a little differently than in earlier examples.
  With "free" input, the data from the "no additives" condition can be arranged in three columns on the left and the data from the "additives" condition arranged on the right. This saves some space, and makes it easier to examine all of the data at one time.

The first part of the "MANOVA" command looks much like that of the "ONEWAY", except that there are two or more DVs listed before the "by". The IV is again listed after "by", with the lowest and highest code values given in parentheses.

This requests both multivariate and univariate analyses of these data.

This requests the univariate summary statistics.

Output:

```
Cell Means and Standard Deviations
Variable .. SCHLACT          activity level at school - DV
     FACTOR           CODE       Mean  Std. Dev.        N

  COND           no addit      28.667     3.082          9
  COND           additive      32.667     4.637          9
For entire sample             30.667     4.339         18




Variable .. HOMEACT          activity level at school - DV
     FACTOR           CODE       Mean  Std. Dev.        N

  COND           no addit      36.000     4.213          9
  COND           additive      44.778     5.995          9
For entire sample             40.389     6.757         18




* * ANALYSIS  OF  VARIANCE — DESIGN   1 * *

 EFFECT .. COND
 Multivariate Tests of Significance (S = 1, M = 0, N = 6 1/2)

 Test Name    Value   Approx. F  Hypoth. DF  Error DF  Sig. of F

 Pillais      .46220   6.44558     2.00      15.00        .010
 Hotellings   .85941   6.44558     2.00      15.00        .010
 Wilks        .53780   6.44558     2.00      15.00        .010
 Roys         .46220




 Univariate F-tests with (1,16) D. F.

 Variable Hypoth. SS Error SS Hypoth. MSError MS    F  Sig. of F

 SCHLACT     72.000  248.000   72.000   15.500    4.645   .047
 HOMEACT    346.722  429.555  346.722   26.847   12.914   .002
```

Univariate statistics for each DV.

Multivariate significance test. SPSS provides four multivariate tests (three with an aproximate F-value and associated p-value). With two IV conditions and equal sample sizes, these F-approximations will be equal. Usually they produce equivalent decisions about whether to reject or retain H0:. Wilks is probably the most commonly reported multivariate summary statistic.

Based on these results we would reject the multivariate H0: and conclude that there is a multivariate mean difference involving these DVs, between these two IV conditions.

Reporting the Results

The activity levels of the students are summarized in Table 1. There was a multivariate difference between those student who had eaten food with additives and those who had not (Wilks = .538, F(2,15) = 6.45, p = .01). As hypothesized, students who had eaten food with additives exhibited higher mean activity levels than did those who had not, both at school (F(1,16) = 4.65, Mse = 15.5, p = .047) and at home (F(1,16) = 12.91, Mse = 26.85, p = .002).

Table 1.
Mean (stdev) school and home activity levels for students who did and did not eat food with additives.

Activity Measure	Treatment Condition	
	No Additives	Additives
Activity at School	28.67 (3.08)	32.67 (4.64)
Activity at Home	36.00 (4.21)	44.78 (6.00)

These "univariate" F-tests reveal signficant difference between the IV conditions for each of the DVs.