C:\Program Files\SYSTAT 12\Data\Repeat2.syz

| | NOISE | P1D1 | P1D2 | P1D3 | P2D1 | P2D2 | P2D3 | P3D1 | P3D2 | P3D3 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 45.000 | 53.000 | 60.000 | 40.000 | 52.000 | 57.000 | 28.000 | 37.000 | 46.000 |
| 2 | 1.000 | 35.000 | 41.000 | 50.000 | 30.000 | 37.000 | 47.000 | 25.000 | 32.000 | 41.000 |
| 3 | 1.000 | 60.000 | 65.000 | 75.000 | 58.000 | 54.000 | 70.000 | 40.000 | 47.000 | 50.000 |
| 4 | 2.000 | 50.000 | 48.000 | 61.000 | 25.000 | 34.000 | 51.000 | 16.000 | 23.000 | 35.000 |
| 5 | 2.000 | 42.000 | 45.000 | 55.000 | 30.000 | 37.000 | 43.000 | 22.000 | 27.000 | 37.000 |
| 6 | 2.000 | 56.000 | 60.000 | 77.000 | 40.000 | 39.000 | 57.000 | 31.000 | 29.000 | 46.000 |

## *Example 12*
## *Repeated Measures ANOVA for Two Trial Factors*

Repeated Measures enables you to handle several trial factors, so we include an example with two trial factors. It is an experiment from Winer, Brown and Michels (1991), which has one grouping factor (*NOISE*) and two trials factors (*PERIODS* and *DIALS*). The trial factors must be sorted into a set of dependent variables (one for each pairing of the two factors groups). It is useful to label the levels with a convenient mnemonic. The file is set up with variables *P1D1* through *P3D3*. Variable *P1D2* indicates a score in the *PERIODS* = *1*, *DIALS* = *2* cell. The data are in the file *REPEAT2*.

The input is:

```
ANOVA
   USE REPEAT2
   CATEGORY NOISE
   DEPEND P1D1 .. P3D3 / REPEAT=3,3 NAMES='period','dial'
   PLENGTH MEDIUM
   ESTIMATE
```

Notice that REPEAT specifies that the two trial factors have three levels each. ANOVA assumes the subscript of the first factor will vary the slowest in the ordering of the dependent variables. If you have two repeated factors (*DAY* with four levels and *AMPM* with two levels), you should select eight dependent variables and type Repeat=4, 2. The repeated measures are selected in the following order:

```
DAY1_AM  DAY1_PM  DAY2_AM  DAY2_PM  DAY3_AM  DAY3_PM  DAY4_AM
DAY4_PM
```

From this indexing, it generates the proper main effects and interactions. When more than one trial factor is present, ANOVA lists each dependent variable and the associated level on each factor.

The input is:

```
GLM
   USE REPEAT2
   CATEGORY NOISE
   MODEL P1D1 .. P3D3 = CONSTANT + NOISE / REPEAT=3,3,
                                           NAMES='period','dial'
   PLENGTH MEDIUM
   ESTIMATE
```

Session Start: Wednesday, March 12th, 2014.

▼File: Untitled1.syz

▼File: C:\Program Files\SYSTAT 12\Data\REPEAT2.syz

Number of Variables : 10
Number of Cases : 6

SYSTAT Rectangular file C:\Program Files\SYSTAT 12\Data\REPEAT2.syz, created Mon May 21 16:17:38 2007, contains variables:

| NOISE | P1D1 | P1D2 | P1D3 | P2D1 | P2D2 |
|---|---|---|---|---|---|
| P2D3 | P3D1 | P3D2 | P3D3 | | |

▼Analysis of Variance

N of Cases Processed : 6

Dependent Variable Means

| P1D1 | P1D2 | P1D3 | P2D1 | P2D2 |
|---|---|---|---|---|
| 48.000 | 52.000 | 63.000 | 37.167 | 42.167 |

Dependent Variable Means

| P2D3 | P3D1 | P3D2 | P3D3 |
|---|---|---|---|
| 54.167 | 27.000 | 32.500 | 42.500 |

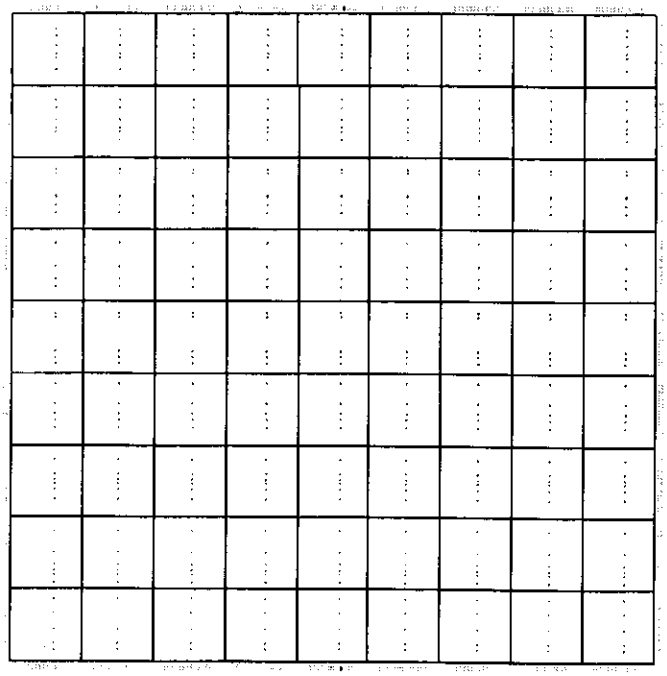
Repeated Measures Factors and Levels of Dependent Variables

| Within Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| period | 1.000 | 1.000 | 1.000 | 2.000 | 2.000 | 2.000 | 3.000 |
| dial | 1.000 | 2.000 | 3.000 | 1.000 | 2.000 | 3.000 | 1.000 |

Repeated Measures Factors and Levels of Dependent Variables

| Within Factor | 8 | 9 |
|---|---|---|
| period | 3.000 | 3.000 |
| dial | 2.000 | 3.000 |

## Plot of Residuals vs Predicted Values



Univariate and Multivariate Repeated Measures Analysis

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| period | 3,722.333 | 2 | 1,861.167 | 32.773 | 0.000 | 0.001 | 0.000 |
| Error | 567.889 | 10 | 56.789 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.667 |
| Huynh-Feldt Epsilon | 0.818 |

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| dial | 2,370.333 | 2 | 1,185.167 | 76.026 | 0.000 | 0.000 | 0.000 |
| Error | 155.889 | 10 | 15.589 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.792 |
| Huynh-Feldt Epsilon | 1.000 |

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| period*dial | 10.667 | 4 | 2.667 | 0.385 | 0.817 | 0.693 | 0.790 |
| Error | 138.444 | 20 | 6.922 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.508 |
| Huynh-Feldt Epsilon | 0.860 |

**Multivariate Repeated Measures Analysis**

Test of: period

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| Wilks's Lambda | 0.069 | 2 | 4 | 26.913 | 0.005 |
| Pillai Trace | 0.931 | 2 | 4 | 26.913 | 0.005 |
| Hotelling-Lawley Trace | 13.457 | 2 | 4 | 26.913 | 0.005 |

Test of: dial

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| Wilks's Lambda | 0.019 | 2 | 4 | 106.061 | 0.000 |
| Pillai Trace | 0.981 | 2 | 4 | 106.061 | 0.000 |
| Hotelling-Lawley Trace | 53.031 | 2 | 4 | 106.061 | 0.000 |

Test of: period*dial

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| Wilks's Lambda | 0.521 | 4 | 2 | 0.459 | 0.771 |
| Pillai Trace | 0.479 | 4 | 2 | 0.459 | 0.771 |
| Hotelling-Lawley Trace | 0.918 | 4 | 2 | 0.459 | 0.771 |

## ▼File: C:\Program Files\SYSTAT 12\Data\REPEAT2.syz

Number of Variables : 10
Number of Cases : 6

SYSTAT Rectangular file C:\Program Files\SYSTAT 12\Data\REPEAT2.syz, created Mon May 21 16:17:38 2007, contains variables:

| | | | | | |
|---|---|---|---|---|---|
| NOISE | P1D1 | P1D2 | P1D3 | P2D1 | P2D2 |
| P2D3 | P3D1 | P3D2 | P3D3 | | |

## ▼General Linear Model

Effects coding used for categorical variables in model.
The categorical values encountered during processing are

| Variables | Levels | |
|---|---|---|
| NOISE (2 levels) | 1.000 | 2.000 |

N of Cases Processed : 6

Dependent Variable Means

| P1D1 | P1D2 | P1D3 | P2D1 | P2D2 |
|---|---|---|---|---|
| 48.000 | 52.000 | 63.000 | 37.167 | 42.167 |

Dependent Variable Means

| P2D3 | P3D1 | P3D2 | P3D3 |
|---|---|---|---|
| 54.167 | 27.000 | 32.500 | 42.500 |

Repeated Measures Factors and Levels of Dependent Variables

| Within Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| period | 1.000 | 1.000 | 1.000 | 2.000 | 2.000 | 2.000 | 3.000 |
| dial | 1.000 | 2.000 | 3.000 | 1.000 | 2.000 | 3.000 | 1.000 |

Repeated Measures Factors and Levels of Dependent Variables

| Within Factor | 8 | 9 |
|---|---|---|
| period | 3.000 | 3.000 |
| dial | 2.000 | 3.000 |

Univariate and Multivariate Repeated Measures Analysis

Between Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value |
|---|---|---|---|---|---|
| NOISE | 468.167 | 1 | 468.167 | 0.752 | 0.435 |
| Error | 2,491.111 | 4 | 622.778 | | |

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| period | 3,722.333 | 2 | 1,861.167 | 63.389 | 0.000 | 0.000 | 0.000 |
| period*NOISE | 333.000 | 2 | 166.500 | 5.671 | 0.029 | 0.057 | 0.029 |
| Error | 234.889 | 8 | 29.361 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.648 |
| Huynh-Feldt Epsilon | 1.000 |

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| dial | 2,370.333 | 2 | 1,185.167 | 89.823 | 0.000 | 0.000 | 0.000 |
| dial*NOISE | 50.333 | 2 | 25.167 | 1.907 | 0.210 | 0.215 | 0.210 |
| Error | 105.556 | 8 | 13.194 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.917 |
| Huynh-Feldt Epsilon | 1.000 |

Within Subjects

| Source | SS | df | Mean Squares | F-ratio | p-value | G-G | H-F |
|---|---|---|---|---|---|---|---|
| period*dial | 10.667 | 4 | 2.667 | 0.336 | 0.850 | 0.729 | 0.850 |
| period*dial*NOISE | 11.333 | 4 | 2.833 | 0.357 | 0.836 | 0.716 | 0.836 |
| Error | 127.111 | 16 | 7.944 | | | | |

| | |
|---|---|
| Greenhouse-Geisser Epsilon | 0.513 |
| Huynh-Feldt Epsilon | 1.000 |

Multivariate Repeated Measures Analysis

Test of: period

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| Wilks's Lambda | 0.051 | 2 | 3 | 28.145 | 0.011 |
| Pillai Trace | 0.949 | 2 | 3 | 28.145 | 0.011 |
| Hotelling-Lawley Trace | 18.764 | 2 | 3 | 28.145 | 0.011 |

Test of: period*NOISE

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| Wilks's Lambda | 0.156 | 2 | 3 | 8.111 | 0.062 |
| Pillai Trace | 0.844 | 2 | 3 | 8.111 | 0.062 |
| Hotelling-Lawley Trace | 5.407 | 2 | 3 | 8.111 | 0.062 |

Test of: dial

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| **Wilks's Lambda** | 0.016 | 2 | 3 | 91.456 | 0.002 |
| **Pillai Trace** | 0.984 | 2 | 3 | 91.456 | 0.002 |
| **Hotelling-Lawley Trace** | 60.971 | 2 | 3 | 91.456 | 0.002 |

Test of: dial*NOISE

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| **Wilks's Lambda** | 0.565 | 2 | 3 | 1.155 | 0.425 |
| **Pillai Trace** | 0.435 | 2 | 3 | 1.155 | 0.425 |
| **Hotelling-Lawley Trace** | 0.770 | 2 | 3 | 1.155 | 0.425 |

Test of: period*dial

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| **Wilks's Lambda** | 0.001 | 4 | 1 | 331.445 | 0.041 |
| **Pillai Trace** | 0.999 | 4 | 1 | 331.445 | 0.041 |
| **Hotelling-Lawley Trace** | 1,325.780 | 4 | 1 | 331.445 | 0.041 |

Test of: period*dial*NOISE

| Statistic | Value | Hypothesis df | Error df | F-ratio | p-value |
|---|---|---|---|---|---|
| **Wilks's Lambda** | 0.000 | 4 | 1 | 581.875 | 0.031 |
| **Pillai Trace** | 1.000 | 4 | 1 | 581.875 | 0.031 |
| **Hotelling-Lawley Trace** | 2,327.500 | 4 | 1 | 581.875 | 0.031 |