# Simple Effects Test Following a Significant Interaction

Simple effects tests are follow-up tests when the interaction is significant. They explore the nature of the interaction by examining the difference between groups within one level of one of the independent variables. For example, if there was a significant interaction between violence and training, a simple effects test would compare the difference between violence and no violence conditions for those people who did not receive eyewitness training. Note that there is generally no reason to conduct a simple effects test when the interaction is nonsignificant.

To conduct a simple effects test following a significant interaction, I use the MANOVA command in SPSS (the GLM syntax command could also be used).[1] MANOVA, which stands for multivariate analysis of variance, is only available through syntax. We are not really conducting a multivariate analysis of variance here, because there is only one dependent variable involved (the statistician's definition of a multivariate test is that there are multiple dependent variables involved). However, this older SPSS command was used to conduct a number of different kinds of analyses prior to the addition of windows menus and the GLM procedure.

## Syntax[2]

Below, I provide the syntax for testing the simple effect of violence within the no training group.

| | 1 No training | 2 Training | |
|---|---|---|---|
| 1 No violence | 4.0 | 8.0 | 6.0 |
| 2 Violence | 2.0 | 2.0 | 2.0 |
| | 3.0 | 5.0 | 4.0 |

For the violence factor 1=no violence, 2=violence. For the training factor, 1=no training and 2=training. To test a simple effect, the following syntax commands are used:

```
MEANS VARS=memory by violence by training.

MANOVA memory BY violence(1,2) training(1,2)
  /ERROR=WITHIN
  /DESIGN
  /DESIGN=violence WITHIN training(1).
```

The `MEANS` command simply generates means for all the cells and the marginal means. They can be obtained with an `OMEANS` subcommand in MANOVA, but I like the presentation with the `MEANS` command better.

The MANOVA line lists the dependent variable first and then the two factors. After each factor, the upper and lower values for that independent variable are listed in parentheses. The second subcommand, `/ERROR=WITHIN`, specifies the error term to use and is always the same in any problem. The first `/DESIGN` subcommand generates the full ANOVA (which you may or may not always want). The second `/DESIGN` command, `/DESIGN=violence WITHIN training(1)`, generates the simple effects test by specifying that the two levels of violence should be compared within the first level of training. The `(1)` in this statement refers to ***the first level of the training variable rather than the group coded 1***. If training had been coded 0=no training and 1=training, the `(1)` in

[1] The following GLM syntax produces both simple effects within each level of training:

```
GLM memory BY violence training
  /emmeans = tables(violence*training) compare(violence).
```

[2] This example is based on syntax provided by Page, C., Braver, S.L., & MacKinnon, D.P. (2003). *Levine's guide to SPSS for analysis of variance* (2nd Edition). Mahway, NJ: Erlbaum. GLM could also be used.

this statement would instruct SPSS to test the simple effect within the no training group (i.e., the group coded 0).

Note that the advantage of this type of analysis over separate standard t-tests, because t-tests use only half of the subjects to compute the error term and significance is only based on half the *df*. Using simple effects tests will use the within-cell variation for all the cases in the data set and will result in a smaller and more reliable error term, thus leading to higher power.

## Means

**Report**

MEMORY memory for assailant

| VIOLENCE violent | TRAINING received | Mean | N | Std. Deviation |
|---|---|---|---|---|
| 1.00 no violence | 1.00 no training | 4.0000 | 5 | .70711 |
| | 2.00 training | 8.0000 | 5 | 1.22474 |
| | Total | 6.0000 | 10 | 2.30940 |
| 2.00 violence | 1.00 no training | 2.0000 | 5 | 1.22474 |
| | 2.00 training | 2.0000 | 5 | 1.22474 |
| | Total | 2.0000 | 10 | 1.15470 |
| Total | 1.00 no training | 3.0000 | 10 | 1.41421 |
| | 2.00 training | 5.0000 | 10 | 3.36650 |
| | Total | 4.0000 | 20 | 2.71448 |

## Manova

```
* * * * * * A n a l y s i s   o f   V a r i a n c e * * * * * *

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

         2 designs will be processed.

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

 Tests of Significance for MEMORY using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN CELLS              20.00      16      1.25
 VIOLENCE                  80.00       1     80.00     64.00      .000
 TRAINING                  20.00       1     20.00     16.00      .001
 VIOLENCE BY TRAINING      20.00       1     20.00     16.00      .001

 (Model)                  120.00       3     40.00     32.00      .000
 (Total)                  140.00      19      7.37

 R-Squared =           .857
 Adjusted R-Squared =  .830

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   2 * * * * * *

 Tests of Significance for MEMORY using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN CELLS              20.00      16      1.25
 VIOLENCE WITHIN TRAI      10.00       1     10.00      8.00      .012
 NING(1)
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```