Simple Effects in Mixed Designs

Why Do We Need To Use Syntax?

In Chapters 10 and 11 Discovering Statistics Using SPSS we used SPSS's syntax language to do simple effects for a fully independent factorial design (Box 10.2) and a fully repeated measures factorial design (Box 11.1). However, in Chapter 12 when I talked about mixed designs I neatly avoided the issue of simple effects analysis altogether. Until now, that is.

An Example

Imagine a clinical psychologist wanted to see the effects of a new antidepressant drug called Cheerup. He took 50 people suffering from clinical depression and randomly assigned them to one of five groups. The first group were a waiting list control group (that is, they were people assigned to the waiting list who were not treated during the study), the second took a placebo tablet (i.e. they were told they were being given an antidepressant drug but actually the pills contained sugar and no active agents), the third group took a well-established SSRI antidepressant called Seroxat (Paxil to American readers), the fourth group were given a well established SNRI antidepressant called Effexor[1], the final group were given the new drug, Cheerup. Levels of depression were measured before and after 2 months on the various treatments, and ranged from 0 = as happy as a spring lamb to 20 = pass me the noose. The data are in the file **Depression.sav**.

The design of this study is a two-way Mixed design. There are two independent variables: treatment (no treatment, placebo, Seroxat, Effexor or Cheerup), and time (before or after treatment). Treatment is measured with different participants (and so is between-group) and time is, obviously, measured using the same participants (and so is repeated measures). Hence, the ANOVA we want to use is a 5×2 two-way ANOVA.

Entering the Syntax for Simple Effects

The Simple Effect of Time within levels of Treatment

To do simple effects using syntax we have to first open a syntax window (see Chapter 2 of Discovering Statistics). Having done that we have to type the following commands:

```
MANOVA
  before after BY treat(0 4)
```

This initialises the ANOVA command in SPSS. The second line specifies the variables in the data editor. The first two words before and after are the repeated measures variables (and these words are the words used in the data editor). Anything after BY is a between group measures and so needs to be followed by brackets within which the minimum and maximum values of the coding variable are specified. I called the between-group variable treat, and I coded the groups as 0 = no treatment, 1 = placebo, 2 = Seroxat, 3 = Effexor, 4 = Cheerup. Therefore, the minimum and maximum codes were 0 and 4. So these two lines tell SPSS to start the ANOVA procedure, that there are two repeated measures variables called before and after and that there is a between group variable called treat that has a minimum code of 0 and a maximum of 4.

```
  /WSFACTORS time (2)
```

[1] SSRIs are Selective Serotonin Reuptake Inhibitors and so work selectively inhibit the reuptake of the neurotransmitter serotonin in the brain, whereas SNRIs are the newer Serotonin-Norepinephrine Reuptake Inhibitors, which act not only on serotonin but on another neurotransmitter (from the same family), Norepinephrine. If you're interested in depression then can I shamelessly plug my book on clinical psychology (Field, A. P., (2003). *Clinical Psychology*. Crucial: Exeter. See www.learningmatters.co.uk)!

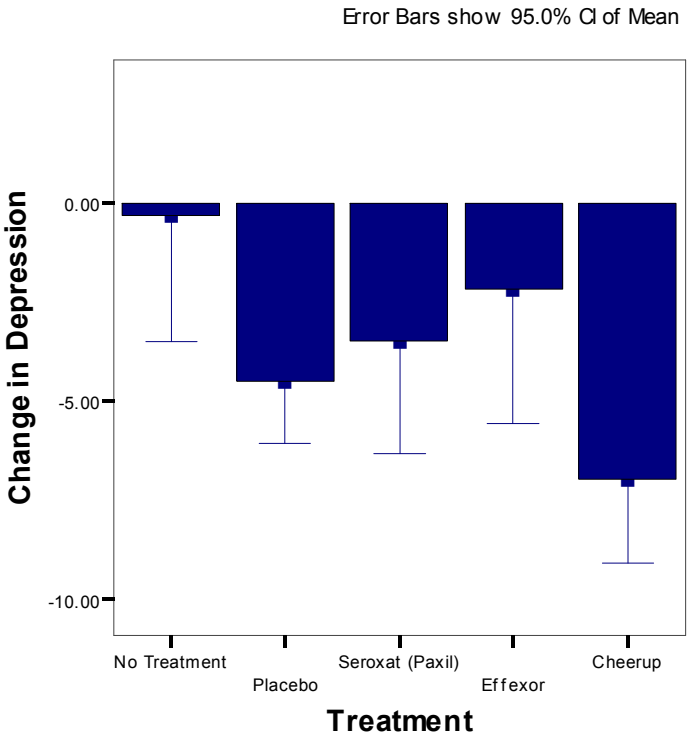
The /WSFACTORS command allows us to specify any repeated measures variables. SPSS already knows that there are two variables called before and after, but it doesn't know how to treat these variables. This command tells SPSS to create a repeated measures variables called time that has two levels (the number in brackets). SPSS then looks to the variables specified before and assigns the first one (before in this case) to be the first level of time, and then assigns the second one (in this case after) to be the second level of time.

```
/DESIGN = MWITHIN treat(1) MWITHIN treat(2) MWITHIN treat(3) MWITHIN treat(4) MWITHIN treat(5).
```

This is used to specify the simple effects. For example, MWITHIN treat(1) asks for the simple effect of time within the first level of the variable 'treatment'. In our data, the first level was the no treatment control group. Likewise, MWITHIN treat(2) will look at the effect of time within level two of the treatment variable, which for our data was the placebo group. Note that the numbers in parentheses do not correspond to the codes we entered. So, for example, the no treatment control was specified in the data with a code of 0, but for the MWITHIN command, we have to start numbering at 1. So, you can read these commands as simple effects of the first, second, third , fourth and fifth levels of the Treatment variable, regardless of what numbers you used to code these groups in the data editor. These simple effects appear in the output as follows:

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

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

         1 design will be processed.
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Tests of Between-Subjects Effects.

 Tests of Significance for T1 using UNIQUE sums of squares
 Source of Variation          SS      DF        MS          F  Sig of F

 WITHIN+RESIDUAL          359.95      45      8.00
 MWITHIN TREAT(1)        5088.05       1   5088.05     636.09      .000
 MWITHIN TREAT(2)        3892.05       1   3892.05     486.57      .000
 MWITHIN TREAT(3)        4590.45       1   4590.45     573.89      .000
 MWITHIN TREAT(4)        4681.80       1   4681.80     585.31      .000
 MWITHIN TREAT(5)        3864.20       1   3864.20     483.09      .000

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Tests involving 'TIME' Within-Subject Effect.

 Tests of Significance for T2 using UNIQUE sums of squares
 Source of Variation          SS      DF        MS          F  Sig of F

 WITHIN+RESIDUAL          320.35      45      7.12
 MWITHIN TREAT(1) BY         .45       1       .45        .06      .803
 TIME
 MWITHIN TREAT(2) BY      101.25       1    101.25      14.22      .000
 TIME
 MWITHIN TREAT(3) BY       61.25       1     61.25       8.60      .005
 TIME
 MWITHIN TREAT(4) BY       24.20       1     24.20       3.40      .072
 TIME
 MWITHIN TREAT(5) BY      245.00       1    245.00      34.42      .000
 TIME

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

The important parts of the output are in bold. These are the simple effects of time within each levelk of the treatment variable. From this we can tell that depression changed significantly as a result of therapy for the placebo group (2), Seroxat(3) and Cheerup (5), but not for Effexor(4) or the no treatment control. This is consistent with the graph below, which shows the change in depression over time within each group: the effect of time (i.e. the change in depression) was not significant in the two groups with the smallest bars.



The Simple Effect of Treatment within levels of Time

To do the opposite simple effects analyse is quite easy. The start of the syntax is the same as before, which just tells SPSS which variables are in use and which columns of the data editor belong to which variables.

```
MANOVA
  before after BY treat(0 4)
  /WSFACTORS time (2)
```

The only difference is in how we specify the simple effects:

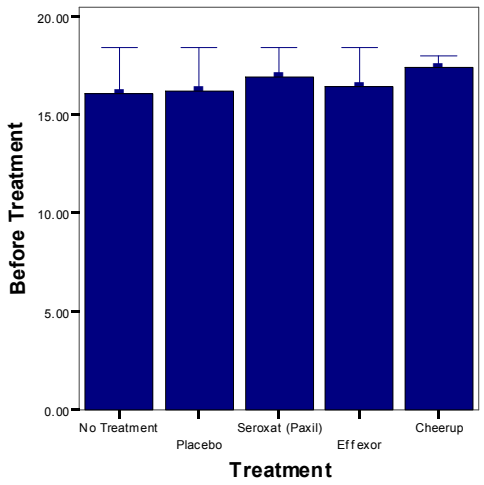
```
/WSDESIGN = MWITHIN time(1) MWITHIN time(2)
/DESIGN.
```

Note that because we are looking at effects within a repeated measures variable we use the subcommand WSDESIGN (within-subjects design) rather than just DESIGN. As before we use MWITHIN to ask for simple effects, but this time we ask to look for effects within the first and second level of the 'time' variable. These simple effects appear in the output as follows:

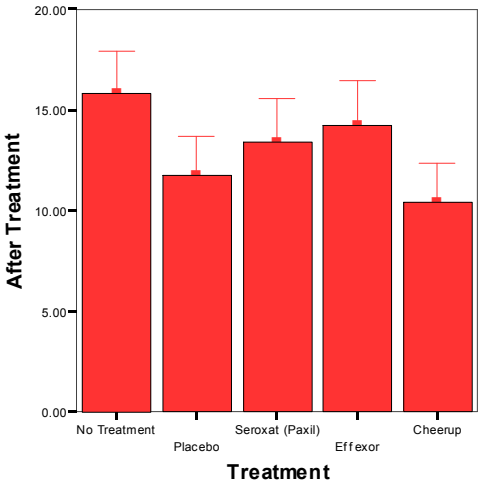
```
* * * * * * A n a l y s i s   o f   V a r i a n c e * * * * * *


        50 cases accepted.
         0 cases rejected because of out-of-range factor values.
```

```
          0 cases rejected because of missing data.
          5 non-empty cells.

          1 design will be processed.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

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

Tests involving 'MWITHIN TIME(1)' Within-Subject Effect.

 Tests of Significance for T1 using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL          304.20      45      6.76
 MWITHIN TIME(1)        13778.00       1  13778.00   2038.17      .000
 TREAT BY MWITHIN TIM      11.80       4      2.95       .44      .782
 E(1)

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

Tests involving 'MWITHIN TIME(2)' Within-Subject Effect.

 Tests of Significance for T2 using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL          376.10      45      8.36
 MWITHIN TIME(2)        8580.50       1   8580.50   1026.65      .000
 TREAT BY MWITHIN TIM     178.40       4     44.60      5.34      .001
 E(2)

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

The two important effects are in bold. These tell us that before therapy (TREAT BY MWITHIN (1)), there were no significant group differences, but after therapy (TREAT BY MWITHIN (2)) there was a big difference between groups.



Depression Before Treatment



Depression After Treatment

The graphs again show what the simple effects represent: in the left panel (before treatment) the groups means are similar, that is, people had similar levels of depression). However, after therapy (right panel) the group means are significantly different: some groups show less depression than others.