**SPSS macro for analyzing two-way interactions and simple slopes (Version 1.1)**
**User notes**
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An SPSS macro is a set of commands that will activate a new SPSS command if you run it once in the syntax window. The present macro activates a command for analyzing two-way interactions and simple slopes in the context of moderated multiple regression analysis.

After running the macro, you can use the following command in the SPSS syntax window:

```
TWOWAY y=    your dependent variable here
/x=          your focal predictor variable here
/m=          your moderator variable here
/z=          standardize predictors, yes (1) or no (0) ?
/rs=         calculate region of significance, yes (1) or no (0)?
/alpha=      your desired alpha level for region of significance (e.g., .05)
/n=          your sample size (after listwise deletion of missings)
/high=       your high conditional value of the moderator variable
/low=   .    your low conditional value of the moderator variable
EXE.
```

The TWOWAY command generates the following output:

Regression analysis
   - the unstandardized regression coefficients (b)
   - the standard errors of the regression coefficients (SE)
   - the variance-covariance matrix of the regression coefficients
Simple slopes
   - the unstandardized simple slopes (b)
   - the standard errors of the simple slopes (SE)
   - the t-value associated with the simple slopes (t)
   - the probability of finding a t-value higher than the observed one given the null hypothesis (b=0) is true (two-sided test)
Region of significance
   1. the upper and lower limits of the region of significance (values of the moderator variable associated with a significant simple slope of the focal predictor)

**Introduction**

In these notes I assume that you have a solid understanding of moderated multiple regression analysis as explained in Cohen, Cohen, West, and Aiken (2003). Whisman and McClelland (2005) wrote a primer on moderated multiple regression analysis including sections on common errors, difficulties in detecting interactions, and design issues. I only explain how to use the macro to produce useful statistics.

1. Important preliminaries

The TWOWAY command relies on SPSS's macro program which cannot deal with missing values. In case your datafile contains any cases with missing values, TWOWAY will remove these cases before carrying out the analyses. The cases will not be deleted from your actual

datafile, but only from the temporary datafile created by TWOWAY. However, TWOWAY will only recognize missing values that appear as , or . in the spreadsheet. Make sure that your datafile does not contain any user-defined missing values such as 99, because these will be treated as real data! For instance, use the command RECODE variable (99=sysmis).

2.  Using the command, Example #1

This section explains the standard case where you would standardize predictor variables and calculate the simple slopes at 1 SD below/above the mean of the moderator variable.
In this example I assume that you have opened an SPSS file that contains three variables: Your dependent variable, your focal predictor variable, and your moderator variable. In order to use TWOWAY, you first have to activate the macro. Run it once in the syntax window.

Now you can use the TWOWAY command as normal SPSS syntax. In most applications, it will be desirable to standardize the predictor variables (i.e., mean = 0, SD = 1) before computing the product term. With standardized predictors, it is more convenient to interpret the regression coefficients and create an interaction plot (see Cohen et al., 2003; Whisman & McClelland, 2005). Therefore, TWOWAY includes a command to standardize variables.

Say your interested in the effect of ability (ABIL) on performance (PERFORM), depending on motivation (MOT). The minimum input required for TWOWAY to work is the following:

```
TWOWAY y= PERFORM /x= ABIL /m= MOT /z= 1.
EXE.
```

Given this input, TWOWAY will first standardize ABIL and MOT, compute the product of the standardized variables, and then do an ordinary least squares regression based on these newly generated variables. The simple slopes printed in the output are those associated with conditional values of 1 SD above/below the mean of the moderator variable. These conditional values are often used for lack of a more theoretically driven value. If you would like to use other conditional values or do not want standardized predictors variables, see Example #2. If you are unsatisfied with using 1 SD above/below the mean as conditional values, but do not have more meaningful values, maybe the region of significance is what you're interested in.

A region of significance indicates „the points on the scale of the moderator at which the effect of the focal predictor passes from significance to nonsignificance at the selected alpha-level" (Bauer & Curran, 2005, p.380). TWOWAY employs equation (21) in Bauer and Curran (2005) to calculate the limits of the region of significance. If you would like to print the region of significance, you have to set rs to 1, specify your alpha-level and the sample size (after listwise exclusion of missings, see above). Say we're interested in the range of MOT over which ABIL is related to PERFORM, and we're using an alpha level of .05 with an effective sample size of n = 100. The following syntax will give us the region of significance:

```
TWOWAY y= PERFORM /x= ABIL /m= MOT /z= 1 /rs= 1 /alpha= .05 /n
= 100.
EXE.
```

3.  Using the command, Example #2

For several reasons you might want to toggle the standardize command off (z=0). For instance, you may have more meaningful conditional values than 1 SD above/below the mean or do not want to standardize predictors because at least one of your predictors is a binary grouping variable. Cohen and his coauthors (2003) describe several useful coding schemes for grouping variables.

If you toggle the standardize command off, make sure your predictor variables are coded appropriately and specify the high and low conditional values. For instance, say the MOT variable from Example #1 carries information about whether a given participant was in the experimental (=high motivation) or control (=low motivation) group. If you have coded MOT as 1 for experimental and 0 for control, you can use the following command to determine the simple slopes of ABIL within the experimental and control groups:

```
TWOWAY y= PERFORM /x= ABIL /m= MOT /z= 0 /high= 1 /low= 0.
EXE.
```

The output will be based on analyses carried out with the raw variables as they appear in your spreadsheet.

The region of significance command will also work with z=0, but it may not make much sense when you use a binary moderator variable.

4. Plotting interactions

Although the TWOWAY macro can facilitate your analyses of two-way interactions, it cannot produce plots of these. Other useful interaction tools are available on the internet (especially for plotting):

http://www.psych.ku.edu/preacher/
http://www.jeremydawson.co.uk/slopes.htm

5. Future versions

If you have suggestions for improving the TWOWAY macro, contact me under ullrich@psych.uni-frankfurt.de. Future versions of the macro will appear on

www.psychologie.uni-frankfurt.de/Abteil/sozial

References

Bauer, D. J., & Curran, P. J. (2005). Probing interactions in fixed an multilevel regression: Inferential and graphical techniques. *Multivariate Behavioral Research, 40*, 373-400.
Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
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