## An Example of a Regression model with “Incomplete” Interactions

Perhaps the most common version of this type of model is when one “explores” whether there are any interactions of a particular predictor with the other predictors in the model. In this example, the question was whether marital status contributed to the model of depression and whether any 2-way interactions including it contributed. The analysis was limited to those folks who were married or single.

**Descriptive Statistics**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| AGE | 405 | 28.48 | 10.885 |
| loneliness | 405 | 37.21 | 11.377 |
| total social support | 405 | 5.6233 | 1.18204 |
| STRESS | 405 | 8.70 | 7.448 |
| socioeconomic status | 405 | 33.30 | 5.229 |
| Valid N (listwise) | 405 | | |

We’ll need the basic descriptive statistics for various things as we go along.

incomplete.SPS - SPSS Synt...

```
compute c_ruls = ruls - 37.21.
compute c_tss = tss - 5.6233.
compute c_stres = stress - 8.70.
compute c_ses = ses - 33.30.

compute s_age = c_stres * c_age.
compute s_ruls = c_stres * c_ruls.
compute s_tss = c_stres * c_tss.
compute s_ses = c_stres * c_ses.

exe.
```

First we center each of the predictors.

Finally we compute the interaction of each predictor with stress.

Opinions about how to proceed vary greatly…

- Some suggest that this type of analysis should not be done, or be done only to provide information for hypotheses for future data/analyses
- Some suggest including each interaction separately, as a way of reducing “chance effects”
- Others suggest a 2-stage model, including the single predictors in the first stage and then adding the set of interactions

The following are from such a 2-stage model – a blatantly exploratory approach!

**Model Summary**

| Model | R | R Square | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|
| 1 | .753[a] | .567 | .567 | 93.434 | 5 | 357 | .000 |
| 2 | .762[b] | .581 | .014 | 2.924 | 4 | 353 | .021 |

a. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS

b. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS, S_
S_AGE, S_SES, S_RULS

**Model Summary**

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b. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS, S_TSS, S_AGE, S_SES, S_RULS

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Std. Error | Standardized Coefficients Beta | t | Sig. | Correlations Zero-order | Partial | Part |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 7.470 | .233 | | 32.034 | .000 | | | |
| | C_AGE | -4.60E-02 | .024 | -.071 | -1.888 | .060 | -.118 | -.099 | -.066 |
| | C_RULS | .106 | .031 | .178 | 3.401 | .001 | .527 | .177 | .118 |
| | C_TSS | -.189 | .250 | -.033 | -.756 | .450 | -.337 | -.040 | -.026 |
| | C_STRES | .220 | .034 | .249 | 6.473 | .000 | .497 | .324 | .225 |
| | C_SES | -.600 | .057 | -.477 | -10.587 | .000 | -.690 | -.489 | -.369 |
| 2 | (Constant) | 7.202 | .252 | | 28.619 | .000 | | | |
| | C_AGE | -6.26E-02 | .025 | -.097 | -2.515 | .012 | -.118 | -.133 | -.087 |
| | C_RULS | .107 | .031 | .181 | 3.461 | .001 | .527 | .181 | .119 |
| | C_TSS | -.201 | .249 | -.035 | -.808 | .419 | -.337 | -.043 | -.028 |
| | C_STRES | .180 | .037 | .203 | 4.872 | .000 | .497 | .251 | .168 |
| | C_SES | -.580 | .058 | -.461 | -9.950 | .000 | -.690 | -.468 | -.343 |
| | S_AGE | -4.55E-03 | .004 | -.049 | -1.282 | .201 | -.089 | -.068 | -.044 |
| | S_RULS | -6.21E-05 | .004 | -.001 | -.016 | .987 | .274 | -.001 | -.001 |
| | S_TSS | -6.60E-02 | .030 | -.100 | -2.209 | .028 | -.240 | -.117 | -.076 |
| | S_SES | -5.97E-03 | .007 | -.043 | -.848 | .397 | -.338 | -.045 | -.029 |

a. Dependent Variable: depression (BDI)

The main effects model did well, and there was a significant increase when the set of interactions were added.

It might be worthwhile to look at the model including just the stress * social support interaction.

This model is given below – once again, note the extreme "exploratory nature" of these analyses!

**Model Summary**

| Model | R | R Square | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|
| 1 | .753[a] | .567 | .567 | 93.434 | 5 | 357 | .000 |
| 2 | .759[b] | .577 | .010 | 8.394 | 1 | 356 | .004 |

a. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS

b. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS, S_TSS

**ANOVA[c]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 9003.746 | 5 | 1800.749 | 93.43 | .000[a] |
| | Residual | 6880.441 | 357 | 19.273 | | |
| | Total | 15884.187 | 362 | | | |
| 2 | Regression | 9162.236 | 6 | 1527.039 | 80.87 | .000[b] |
| | Residual | 6721.951 | 356 | 18.882 | | |
| | Total | 15884.187 | 362 | | | |

a. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS

b. Predictors: (Constant), C_SES, C_AGE, C_TSS, C_STRES, C_RULS, S_TSS

c. Dependent Variable: depression (BDI)

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Std. Error | Standardized Coefficients Beta | t | Sig. | Correlations Zero-order | Partial | Part |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 7.470 | .233 | | 32.034 | .000 | | | |
| | C_AGE | -4.60E-02 | .024 | -.071 | -1.888 | .060 | -.118 | -.099 | -.066 |
| | C_RULS | .106 | .031 | .178 | 3.401 | .001 | .527 | .177 | .118 |
| | C_TSS | -.189 | .250 | -.033 | -.756 | .450 | -.337 | -.040 | -.026 |
| | C_STRES | .220 | .034 | .249 | 6.473 | .000 | .497 | .324 | .225 |
| | C_SES | -.600 | .057 | -.477 | -10.587 | .000 | -.690 | -.489 | -.369 |
| 2 | (Constant) | 7.360 | .234 | | 31.463 | .000 | | | |
| | C_AGE | -5.35E-02 | .024 | -.083 | -2.206 | .028 | -.118 | -.116 | -.076 |
| | C_RULS | .104 | .031 | .175 | 3.368 | .001 | .527 | .176 | .116 |
| | C_TSS | -.179 | .247 | -.031 | -.725 | .469 | -.337 | -.038 | -.025 |
| | C_STRES | .200 | .034 | .226 | 5.799 | .000 | .497 | .294 | .200 |
| | C_SES | -.596 | .056 | -.474 | -10.617 | .000 | -.690 | -.490 | -.366 |
| | S_TSS | -6.86E-02 | .024 | -.104 | -2.897 | .004 | -.240 | -.152 | -.100 |

a. Dependent Variable: depression (BDI)

Including just this interaction leads to it having a significant contribution.

Remember the finding that this interaction contributes and the others don't must be verified by replication and convergent research!!!!

The negative regression weight for the interaction tells us that the slope of the relationship between stress and depression is more positive for with lower TSS (total social support) and a less positive for those with higher TSS – a buffering effect.

However, we would want to see a plot of this interaction.

To do so we have to get the simple regression lines for the relationship between stress and depression separately for high and low values of TSS. In order to do that, we have to decide at what value we want to hold each of the other variables that are in the model (stress and TSS).

To do this, as for previous regression models, we have to “reorganize" the multiple regression model, following the rule that

- Interactions with the X-axis variable (ses) influence the slope of the simple regression lines
- Other interactions and main effects influence the height (y-intercept) of the simple regression lines

Remember that all the predictors have been centered – so their mean = 0. If we follow the common practice of holding the other variables in the model constant at their mean, then this regression equation simplifies to the model including just SES, mdc and their interaction (all other effects “drop out” because they have values = 0).

IntPlot allows you to do this, or to set the “constant” values of the various predictors to specific values to reflect the population you intend to portray.