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Calculating G-theory Quantities Using SPSS Syntax

In this document I explain how to use SPSS to obtain G-theory quantities using SPSS syntax.

SPSS does not have the specialized programs needed to obtain most G-theory quantities. Because of this, I created Excel spreadsheets to calculate these c using the variance components obtained from SPSS. The spreadsheet examples are based on data from the tables in Chapter 10 and available in the SPSS data sets "**Table 10.2 data transposed**, "**Table 10.2 data untransposed**, "**Table 10.4 data transposed**," and "**Table 10.4 data untransposed**."

Although the Excel spreadsheets show the variance components from these examples, they can easily be modified to use with other data. To do so, simply type or paste in the variance component estimates from the other data into the variance component column, and type in the number of levels for these variance components in the column labeled "levels". The other quantities will be updated automatically when these values are changed.

Similarly, although the rows in the spreadsheet are labeled as "raters," "tasks," and their interactions, this was done only to correspond to the textbook examples. These labels can be changed to correspond to any type of facet, such as occasions or items.

Below I provide the syntax to obtain variance components. These variance components can then be entered into the Excel spreadsheets to obtain the G-theory quantities. I first show the commands for a one-facet design and then the commands for a two-facet design.

I begin by providing syntax to transpose the data set, which is often needed to obtain variance component estimates.

One-facet Design

Transposing the Data

Most data sets will need to be transposed prior to obtaining the variance component estimates. This is because data is usually entered in "wide" format, with one row for each person, as shown below:

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Table10-2 data untransposed.sav [DataSet4] - IBM SPSS Statistics Data Editor

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person 4

	person	rater1	rater2	rater3	var
1	1	3.0	5.0	4.0	
2	2	3.0	5.0	5.0	
3	3	1.0	1.0	2.0	
4	4	3.0	1.0	2.0	
5	5	6.0	5.0	5.0	
6	6	1.0	2.0	5.0	
7	7	3.0	5.0	5.0	
8	8	5.0	4.0	5.0	
9	9	3.0	1.0	3.0	
10	10	4.0	3.0	5.0	
11	11	3.0	4.0	3.0	
12	12	2.0	2.0	2.0	
13					

To obtain variance components in SPSS, the data must be transposed to create a variable called “rater” with three levels corresponding to the three raters, and a variable “score” that contains the scores for each person from each rater. In the new data set, there will be three rows for each person, one row for each rater and that rater’s score, as shown below (data are cut off at the bottom):

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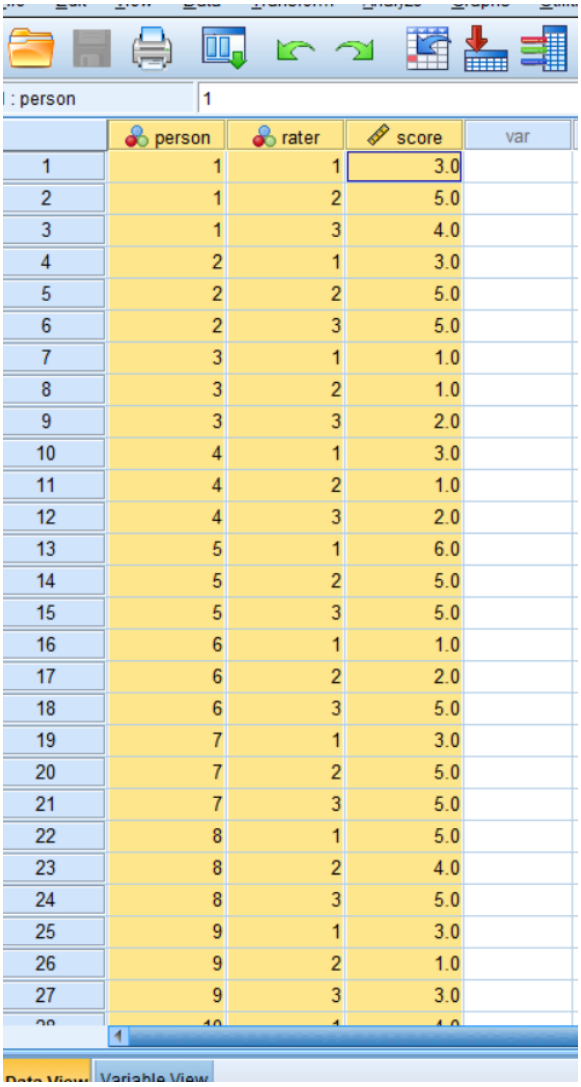

: person | 1

	person	rater	score	var
1	1	1	3.0	
2	1	2	5.0	
3	1	3	4.0	
4	2	1	3.0	
5	2	2	5.0	
6	2	3	5.0	
7	3	1	1.0	
8	3	2	1.0	
9	3	3	2.0	
10	4	1	3.0	
11	4	2	1.0	
12	4	3	2.0	
13	5	1	6.0	
14	5	2	5.0	
15	5	3	5.0	
16	6	1	1.0	
17	6	2	2.0	
18	6	3	5.0	
19	7	1	3.0	
20	7	2	5.0	
21	7	3	5.0	
22	8	1	5.0	
23	8	2	4.0	
24	8	3	5.0	
25	9	1	3.0	
26	9	2	1.0	
27	9	3	3.0	

Data View | Variable View

The **VARSTOCASES** command in SPSS will do the data transformation, using the syntax below:

```
VARSTOCASES
 /MAKE score FROM rater1 rater2 rater3
 /INDEX=rater(3)
 /KEEP = person
 /NULL = KEEP.
```

The command **VARTOCASES** causes SPSS to transpose the data.

The subcommand "**MAKE** score **FROM** rater1 rater2 rater3" creates the variable "score" as the values of rater1, rater2, and rater3.

The next line ("**INDEX=**rater(3)") creates the variable "rater" with values of 1, 2, and 3, corresponding to the three raters.

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The subcommand "**KEEP =** person" specifies that the existing variable "person" should be kept in the dataset.

Finally, the subcommand "**NULL=KEEP**" specifies that a new row should be created even if a person's ratings from all raters are missing. In this case, the variable "score" will be missing for that person.

Running these commands will result in a new window in which the transposed data shown previously will appear. Save the new data set under a new name to use in obtaining the variance components.

Obtaining the Variance Components for the One-facet Data

With the transposed data set open, run the syntax below to obtain the variance components:

```
VARCOMP score BY person rater
  /RANDOM=person rater
  /METHOD=MINQUE(1)
  /DESIGN
  /INTERCEPT=INCLUDE.
```

The dependent variable is "score," predicted by the variables "person" and "rater," which are both treated as random. (If one or more facets are fixed, use the syntax **/FIXED=** XXX). The other commands represent the default choices for the **VARCOMP** procedure.

Running these commands will result in the output below:

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Factor Level Information

		N
person	1	3
	2	3
	3	3
	4	3
	5	3
	6	3
	7	3
	8	3
	9	3
	10	3
	11	3
	12	3
rater	1	12
	2	12
	3	12

Dependent Variable: score

Variance Estimates

Component	Estimate
Var(person)	1.283
Var(rater)	.088
Var(person * rater)	.967
Var(Error)	.000[a]

Dependent Variable: score
Method: Minimum Norm Quadratic Unbiased Estimation (Weight = 1 for Random Effects and Residual)

a. This estimate is set to zero because it is redundant.

The Factor Level Information specifies that there are 12 people in the data set, each with three ratings (this is the “N”). There are three raters, each rating 12 people.

The variance component estimates shown in the second table are the same as those in the spreadsheet for the one-facet crossed design and in Table 10.3 in the text (NOTE THAT IN PRINTINGS 1 AND 2 OF THE BOOK, THESE VALUES ARE INCORRECT IN

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THE TABLE. GO TO THE ERRATA SHEET ON THIS WEBSITE TO OBTAIN THE CORRECTED TABLE).

The variance component values can be entered into the spreadsheet in the appropriate column.

Two-facet Design

The commands for the two-facet design are analogous to those for the one-facet design.

Transposing the Data

Commands to transpose the data for the two-facet design are slightly more complex than those for the one-facet design. The data for the values in Table 10.4 are in the data set "**Table 10.4 data untransposed**." The untransposed data are shown below:

Table 10.4 data untransposed.sav [DataSet16] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

	person	R1Task1	R1Task2	R1Task3	R2Task1	R2Task2	R2Task3	R3Task1	R3Task2	R3Task3	var
1	1	3.0	3.0	3.0	5.0	5.0	5.0	4.0	4.0	5.0	
2	2	3.0	2.0	4.0	5.0	5.0	5.0	5.0	3.0	5.0	
3	3	1.0	1.0	2.0	1.0	3.0	3.0	2.0	3.0	4.0	
4	4	3.0	2.0	2.0	1.0	3.0	2.0	2.0	1.0	1.0	
5	5	6.0	6.0	6.0	5.0	5.0	6.0	5.0	4.0	3.0	
6	6	1.0	2.0	1.0	2.0	1.0	1.0	5.0	3.0	2.0	
7	7	3.0	2.0	3.0	5.0	1.0	2.0	5.0	4.0	5.0	
8	8	5.0	4.0	6.0	4.0	3.0	5.0	5.0	4.0	6.0	
9	9	3.0	2.0	3.0	1.0	3.0	1.0	3.0	1.0	3.0	
10	10	4.0	3.0	4.0	3.0	3.0	3.0	5.0	4.0	2.0	
11	11	3.0	2.0	5.0	4.0	3.0	4.0	3.0	2.0	3.0	
12	12	2.0	1.0	1.0	2.0	2.0	1.0	2.0	2.0	4.0	
13											
14											

Each person has nine scores: ratings from three raters (labeled R1, R2, R3) on three tasks (Task1, Task2, and Task3). The label R1Task1 refers to the rating by Rater 1 on Task 1, and so on.

What is needed is a transposed data set with new variables for rater, task, and score. This can be obtained by running the syntax below with the data set "**Table 10.4 data untransposed.sav**."

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```
VARSTOCASES
 /make score from R1Task1 R1Task2 R1Task3 R2Task1 R2Task2 R2Task3 R3Task1
 R3Task2 R3Task3
  /index=rater(3) task(3)
  /keep = person
  /null = keep.
```

The commands are similar to those for the one-facet design, except that now there are two index variables, rater, which goes from 1 – 3, and task, which also goes from 1 – 3.

In the untransposed data set, all three tasks for Rater 1 are first, then all three tasks for Rater 2, then all three tasks for Rater 3.

SPSS assumes that the variable listed first on the **MAKE** subcommand is the first index and the second variable is the second index. This means that SPSS will assume that the first three variables listed on the **MAKE** subcommand will be those for Rater 1, Tasks 1 – 3, the next three variables will be those for Rater 2, Tasks 1 – 3, and so on.

Running these commands will yield the transposed data set below (note that not all rows are shown):

Table 10.4 data transposed.sav [DataSet15] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions

	person	rater	task	score	var
1	1	1	1	3.0	
2	1	1	2	3.0	
3	1	1	3	3.0	
4	1	2	1	5.0	
5	1	2	2	5.0	
6	1	2	3	5.0	
7	1	3	1	4.0	
8	1	3	2	4.0	
9	1	3	3	5.0	
10	2	1	1	3.0	
11	2	1	2	2.0	
12	2	1	3	4.0	
13	2	2	1	5.0	
14	2	2	2	5.0	
15	2	2	3	5.0	
16	2	3	1	5.0	
17	2	3	2	3.0	
18	2	3	3	5.0	
19	3	1	1	1.0	
20	3	1	2	1.0	
21	3	1	3	2.0	
22	3	2	1	1.0	
23	3	2	2	3.0	

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Obtaining the Variance Components for the Two-facet Data

Run the following syntax to obtain the variance components for the two-facet data:

```
VARCOMP score BY person rater task
  /RANDOM=person rater task
  /METHOD=MINQUE(1)
  /DESIGN
  /INTERCEPT=INCLUDE.
```

This syntax adds one more variable ("task") to the **RANDOM** subcommand. Running the syntax will result in the tables below:

Factor Level Information

		N
person	1	9
	2	9
	3	9
	4	9
	5	9
	6	9
	7	9
	8	9
	9	9
	10	9
	11	9
	12	9
rater	1	36
	2	36
	3	36
task	1	36
	2	36
	3	36

Dependent Variable: score

The table above shows that there are 12 people with nine scores each (3 ratings on each of 3 tasks). There are three raters yielding 36 ratings (ratings from 3 raters for each of 12 people) and ratings on 36 tasks (ratings on 3 tasks for each of 12 people).

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The variance components shown below are the same as those in Table 10.4 in the text and in the Excel spreadsheet on the sheet labeled "**Two-facet crossed**."

Variance Estimates

Component	Estimate
Var(person)	1.035
Var(rater)	-.004[a]
Var(task)	.061
Var(person * rater)	.471
Var(person * task)	.120
Var(rater * task)	.012
Var(person * rater * task)	.641
Var(Error)	.000[b]

Dependent Variable: score
Method: Minimum Norm Quadratic Unbiased Estimation (Weight = 1 for Random Effects and Residual)

a. For the ANOVA and MINQUE methods, negative variance component estimates may occur. Some possible reasons for their occurrence are: (a) the specified model is not the correct model, or (b) the true value of the variance equals zero.

b. This estimate is set to zero because it is redundant.