

Contrasts, Comparisons, and Simple Effects in Mixed Designs

I. Simple main effect with A-between and B-within

A. $SS_{B@A1}$

Divide the data according to factor A so that you have the data for only those who were in condition A1. Run ordinary repeated measures ANOVA on A1 subjects only. This can be done by filtering the data in SPSS, or you can create a new data set with only the Ss in condition A1.

B. $SS_{A@B1}$

Divide the data according to factor B. Run between-Ss ANOVA on B1 condition only. To do this in SPSS you would just select B1 as the dependent variable and ignore the other observations on each person.

II. Simple interaction effect with A- and B-between and C- and D-within.

A. $SS_{CD@A1B1}$ (a simple interaction of the two repeated measures factors)

Divide data so that you have only those in cell A_1B_1 . Run ordinary repeated measures ANOVA on those Ss only.

B. $SS_{AB@C1D1}$ (a simple interaction of the two between-subject factors)

Divide data according to CD combinations so that you have only the data from the C1D1 cell. Run ordinary A x B between groups ANOVA on the C1D1 dependent variable only. To do this, you use the DV from the C1D1 cell only.

III. Single df tests (contrasts) on means with A-between and B-within.

A. Factor A means (contrasts on the between factor main effect means)

Data are means (or totals) for each subject averaged over (or pooled over) the levels of factor B, the within factor. Simply run an ordinary between-subjects contrast using the S/A error term from the omnibus ANOVA.

B. Factor B means (contrasts on the repeated measure main effect means)

Data are Ψ -hat values for each subject. See IV.A.6 for how to run the test.

IV. Interaction contrasts (alternate method to Keppel's) A-between and B-within

A. $A \times B_{\text{comp}}$.

Data from a previous edition of Keppel.

Numerical example: $A \times (B \times S)$ Design

ABS Matrix									
a ₁					a ₂				
	b ₁	b ₂	b ₃	b ₄		b ₁	b ₂	b ₃	b ₄
S ₁	3	4	7	3	S ₁	5	6	11	7
S ₂	6	8	12	9	S ₂	10	12	18	15
S ₃	7	13	11	11	S ₃	10	15	15	14
S ₄	0	3	6	6	S ₄	5	7	11	9

Want $A \times B_{\text{linear}}$
 Coeffs = -3, -1, 1, 3

1. First compute $\sum c_i B_i = \Psi$ separately for each subject.

	*C1		C2
	$\Psi@A1$		$\Psi@A2$
S ₁	3	S ₅	11
S ₂	13	S ₆	21
S ₃	10	S ₇	12
S ₄	<u>21</u>	S ₈	<u>16</u>
$\sum \Psi$	47		60

2. Compute

$$SS_C = [C] - [T] = \frac{47^2 + 60^2}{4} - \frac{107^2}{8} = 1452.25 - 1431.125 = 21.125$$

3. Compute

$$SS_{S/C} = [CS] - [C] = \frac{1681}{1} - 1452.25 = 228.75$$

4. Compute ANOVA for C (I have omitted the Mean below).

Source	df	SS	MS	F
C	1	21.125	21.125	.55
S/C	6	228.75	38.125	--

5. Note: This gives the correct F ratio, but the various sums of squares are not normalized and hence cannot be compared to the SS from the omnibus ANOVA.

If you need normalized SS, simply divide the SS from the C-matrix by $n^* \sum c_j^2$ where n^* is the number of observations in the score to which the coefficients have been applied. This (n^*) is usually 1.

6. What if you want to know the F for something like B-linear pooled over the A factor (that is a contrast on the within factor pooled over the between factor)?

- a. Compute SS_{mean} for the SC array as given above.

$$SS_{\text{mean}} = [T] = \frac{(47 + 60)^2}{8} = 1431.125$$

- b. Divide by proper error term (S/C) to get

$$F = \frac{1431.125}{38.125} = 37.54$$

Note again, F ratio is correct, but the SS values are not normalized to be comparable to OMNIBUS ANOVA. To get normalized values divide each SS by $n^* \sum c_j^2$.

7. Overall Summary Table

Source in Original Terms	Source in C Terms	df	SS in C Terms	MS in C Terms	F in Either Terms
B_{LINEAR}	Mean	1	1431.125	1431.125	37.54
$A \times B_{\text{LINEAR}}$	C	1	21.125	21.125	.55
$B_{\text{LINEAR}} \times S/A$	S/C	6	228.75	38.125	--
TOTAL		8			

8. $A_{\text{comp}} \times B$

This analysis is easy. The contrast coefficients are applied to the between factor means and the error term is simply the MS for the interaction involving the A, B, and S factors. This is B x S/A from the omnibus ANOVA of all the data. If this seems confusing, just remember that S cannot interact with A or with A-comp since subjects are nested in (or experience only one level of) A.