Factorial ANOVA

Cell Descriptive Statistics (Factor A * B)

CI %:

Factor A	Factor B	N	M	SD	Lower
1	1	4	2.000	2.449	-0.668
	2	4	7.000	2.449	4.332
2	1	4	6.000	2.449	3.332
	2	4	5.000	2.449	2.332

Marginal Descriptive Statistics (Factor A)

A	B	N	M	SD	Lower
1	Total	8	4.500	3.505	2.613
3	Total	8	5.500	2.330	3.613

Marginal Descriptive Statistics (Factor B)

A	B	N	M	SD	Lower
Total	1	8	4.000	3.117	2.113
Total	2	8	6.000	2.507	4.113

Tests of Between Subjects Effects

Source	SS	df	MS	F	p	Eta-Sq
Factor A	4.000	1	4.000	0.667	0.430	0.053
Factor B	16.000	1	16.000	2.667	0.128	0.182
A * B	36.000	1	36.000	6.000	0.031	0.333
Within	72.000	12	6.000			
Total	128.000					

These descriptive statistics are calculated separately for each group or condition. A level (marginal) mean can be determined by taking the weighted average of the appropriate group means. For example, the marginal mean for Level 1 of Factor A:

$$M_{LEVEL} = \frac{\sum n(M_{GROUP})}{n_{LEVEL}} = \frac{4(2) + 4(7)}{8} = 4.500$$

A grand mean can be determined by taking the weighted average of all of the group means:

$$M_{TOTAL} = \frac{\sum n(M_{GROUP})}{N} = \frac{4(2) + 4(7) + 4(6) + 4(5)}{4 + 4 + 4 + 4} = 5.000$$

The statistics for the effects of "Factor A" and Factor B" are functions of the level (marginal) means and sample sizes. For "Factor B":

$$SS_{FACTORB} = \sum n(M_{LEVEL} - M_{TOTAL})^2 = 8(4.5 - 5)^2 + 8(5.5 - 5)^2 = 4.000$$
$$df_{FACTORB} = \#levels - 1 = 2 - 1 = 1$$

The "Factor A * Factor B" (interaction) statistics reflect the between- group variability not accounted for by the factors:

$$SS_{INTERACTION} = SS_{MODEL} - SS_{FACTORA} - SS_{FACTORB} == 56.000 - 4.000 - 16.000 = 36.000$$
$$df_{INTERACTION} = df_A \times df_B = 1$$

"WithinI" (error) statistics are a function of the within group variabilities. Because SS for each group can be determined ($SS = SD^2 \times df$):

$$SS_{ERROR} = SS_1 + SS_2 + SS_3 + SS_4 = 18.000 + 18.000 + 18.000 + 18.000 = 72.000$$
$$df_{ERROR} = df_1 + df_2 + df_3 + df_4 = 12$$

The "F" statistic is a ratio of the effect and within group (error) variance estimates. For "Factor B":

$$F_{FACTORB} = \frac{MS_{FACTORB}}{MS_{ERROR}} = \frac{16.0}{6.0} = 2.667$$

An *F* with 1 and 12 *df* that equals 2.667 has a two-tailed probability of .128, which is not statistically significant.

The partial "Eta-Squared" statistic is a ratio of the effect and the effect plus residual variability. For "Factor B":

$$\eta^2 p = \frac{SS_{FACTOR}}{SS_{FACTOR} + SS_{ERROR}} = \frac{16.000}{16.000 + 72.000} = 0.182$$

Thus, 18.2% of the variability among the scores is accounted for by Factor B.