Repeated Measures ANOVA

(Additional analyses have been added for the sake of completeness!)

Descriptives

	Outcome1	Outcome2
N	4	4
Missing	0	0
Mean	2.000	6.000
Standard deviation	2.449	2.449

These descriptive statistics are calculated separately for each level or condition.

Because sample sizes are equal, a grand mean can be determined by averaging these two level means:

$$M_{TOTAL} = (M_{LEVEL} + M_{LEVEL})/2 = (2.000 + 6.000)/2 = 4.000$$

Between Subjects Effects

	Sum of Squares	df	Mean Square	F	p	partial η²
Residual	27.000	3	9.000			

Between-subjects "Residual" (or error) refers to the average differences across the participants of the study. This Sum of Squares is not easily determined from the summary statistics output, but rather from the data (and the calculations are therefore not shown here). However:

$$df_{SUBJECTS} = \#subjects - 1 = 3$$

The "Mean Square" is the usual ratio of the Sum of Squares to the degrees of freedom.

Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	partial η²
Factor	32.000	1	32.000	10.667	0.047	0.780
Residual	9.000	3	3.000			

The "F" statistic is a ratio of the effect and within-subjects error variance estimates:

$$F = \frac{MS_{EFFECT}}{MS_{ERROR}} = \frac{32.000}{3.000} = 10.667$$

An *F* with 1 and 3 *df* that equals 10.667 has a two-tailed probability of .047, a statistically significant finding.

The statistics for the effect (or change) on the "Factor" are functions of the means of the levels or conditions and the sample sizes:

$$SS_{EFFECT} = \sum n_{LEVEL}(M_{LEVEL} - M_{TOTAL})^2$$
$$SS_{EFFECT} = 4(2.0 - 4.0)^2 + 4(6.0 - 4.0)^2$$
$$SS_{EFFECT} = 32.000$$
$$df_{EFFECT} = \#levels - 1 = 1$$

The "Mean Square" is the usual ratio of the Sum of Squares to the degrees of freedom.

$$MS_{EFFECT} = \frac{SS_{EFFECT}}{df_{EFFECT}} = \frac{32.000}{1} = 32.000$$

The within-subjects "Residual" (or error) is a function of variabilities of the separate levels or conditions of the factor and the "between-subjects error" given above. Because SS for each level can be determined (*SS* = *SD*^{2} *x df*, which equals 18.000 for each of the two outcomes):

$$SS_{ERROR} = SS_1 + SS_2 - SS_{SUBJECTS}$$
$$SS_{ERROR} = 18.000 + 18.000 - 27.000 = 9.000$$
$$df_{ERROR} = df_1 + df_2 - df_{SUBJECTS} = 3 + 3 - 3 = 3.000$$

The "Mean Square" is the usual ratio of the Sum of Squares to the degrees of freedom.

The partial "η²" statistic is a ratio of the effect and the total group variability ("Sum of Squares") estimates:

$$Partial\ \eta^2 = \frac{SS_{EFFECT}}{SS_{EFFECT} + SS_{ERROR}}$$
$$Partial\ \eta^2 = \frac{32.000}{32.000 + 9.000} = 0.780$$

Thus, 78.0% of the variability in Outcome scores (after removing individual differences) is accounted for by the repeated measures Factor.