Independent Samples t Test

(Note that some aspects of this output have been rearranged for the sake of presentation!)

Group Descriptives

	Group	N	Mean	Median	SD	SE
Outcome	1	4	2.000	1.500	2.449	1.225
	2	4	6.000	5.500	2.449	1.225

These values of the group statistics are calculated separately for each level or condition. They are not identical to the values obtained from analyzing the variable as a whole.

These are the standard errors for each condition calculated separately. For the first condition:

$$SE_M = \frac{SD}{\sqrt{N}} = \frac{2.449}{\sqrt{4}} = 1.225$$

Notice that the standard errors are equal because both groups have the same standard deviation and sample size.

The pooled (or weighted average) Std. Deviation of the groups can be determined from the group descriptive statistics:

$$SD_{WITHIN} = \sqrt{\frac{(SD_1^2)(df_1) + (SD_2^2)(df_2)}{df_1 + df_2}} = \sqrt{\frac{(2.449^2)(3) + (2.449^2)(3)}{3+3}} = 2.449$$

Cohen's d" provides a standardized effect size for the difference between the two means:

$$d = \frac{M_{DIFF}}{SD_{WITHIN}} = \frac{-4.000}{2.449} = -1.633$$

Independent Samples T-Test

		statistic	df	p	Mean difference	SE difference	Cohen's d	95% Confidence Interval Lower	95% Confidence Interval Upper
Outcome	Student's t	-2.309	6.000	0.060	-4.000	1.732	-1.633	-8.238	0.238

The “statistic”, “df”, and “p” columns provide the results of the statistical significance test. First, *t* provides the standardized statistic for the mean difference:

$$t = \frac{M_1 - M_2}{SE_{DIFF}} = \frac{-4.000}{1.732} = -2.309$$

The *t* statistic follows a non-normal (studentized or *t*) distribution that depends on degrees of freedom. Here, *df* = N – 2 = 8 – 2 = 6. A *t* with 6 df that equals -2.309 has a two-tailed probability (*p*) of .060, a finding that is not statistically significant.

The “Mean Difference” is the difference between the two group means. For the example, group one's mean was 4 points lower.

The “SE Difference” is a function of the two groups' individual standard errors. When sample sizes are equal:

$$SE_{DIFF} = \sqrt{SE_1^2 + SE_2^2}$$

$$SE_{DIFF} = \sqrt{1.225^2 + 1.225^2} = 1.732$$

This value is important for both the significance test and the confidence interval. [Importantly, the computation of the standard error of the difference is more complex for unequal sample sizes.]

This section provides a confidence interval around (centered on) the “Mean Difference.” Calculation requires the appropriate critical value. Specifically, the *t* statistic (with 6 *df*) that has a probability of .05 equals 2.447. As a result:

$$CI_{DIFF} = M_{DIFF} \pm (t_{CRITICAL})(SE_{DIFF})$$
$$CI_{DIFF} = -4 \pm (2.447)(1.732)$$

Thus, the researcher estimates that the true population mean difference is somewhere between -8.238 and .238 (knowing that the estimate could be incorrect).