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Tutorial 21: Planned Contrasts and Post-hoc Contrasts with One Way ANOVA

Description

In this tutorial we will learn how to conduct planned contrasts and post-hoc contrasts with One Way ANOVA. Contrasts are comparisons of two means. Typically, when conducting an ANOVA we tend to compare more than two means. An overall ANOVA test that shows statistical significance (p-value < .05) only indicates that there is a difference among at least one pair of means but does not tell us which two means are different. For example, if we are testing the following hypotheses, comparing three sample means:

H_0: $\mu_A = \mu_B = \mu_C$

H_a: $\mu_A \neq \mu_B, \mu_A \neq \mu_C, \mu_B \neq \mu_C$

(note: the alternative hypothesis H_a can also be denoted as H_1)

and let's say the One Way ANOVA test conducted indicated a p-value < .05 (see tutorial #20), then we can conclude that there is a significant difference among the three means but we do not know exactly which pair of means are statistically significantly different. To figure this out we must conduct post-hoc contrasts - these are tests that contrast each pair of means to test. The difference between planned and post-hoc contrasts is when conducting planned contrasts you already know which specific pairs to test (you have hypotheses about the specific pairs of means), but post-hoc contrasts are typically done post or after you have conducted the One Way ANOVA and found a statistical difference among the means, and want to hone in on which pair of means are actually statistically significantly different from one another. So when you conduct post-hoc contrasts you do not have hypotheses about which specific pair of means are supposed to be statistically different from one another.

Planned and post-hoc contrasts in Jamovi can be carried out similarly (same set of steps).

For this tutorial we will conduct post-hoc contrasts examining where the difference in mean level of warmth attributed to Kathy was among the three apology conditions (No Apology, Half Apology, Full Apology). So we will be building on tutorial #20 to carry out the contrasts.

Note: we are using the datafile ARMF2020_wave1andwave2.omv

Note. *ANOVAs in Jamovi will only work with ordinal or continuous variables as dependent vairables. If your variable is identified as nominal Jamovi will not allow you to select it as a dependent variable. So before beginning please make sure that the variable you are interested*

in is ordinal (integer) or continuous.

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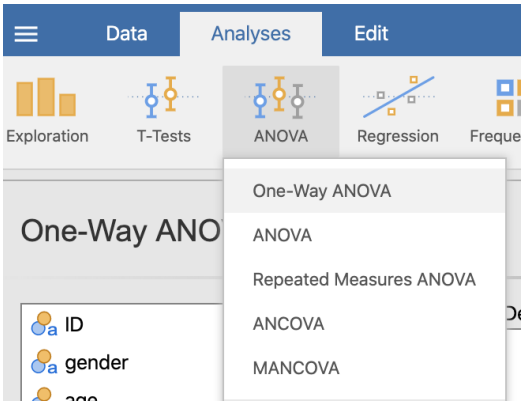
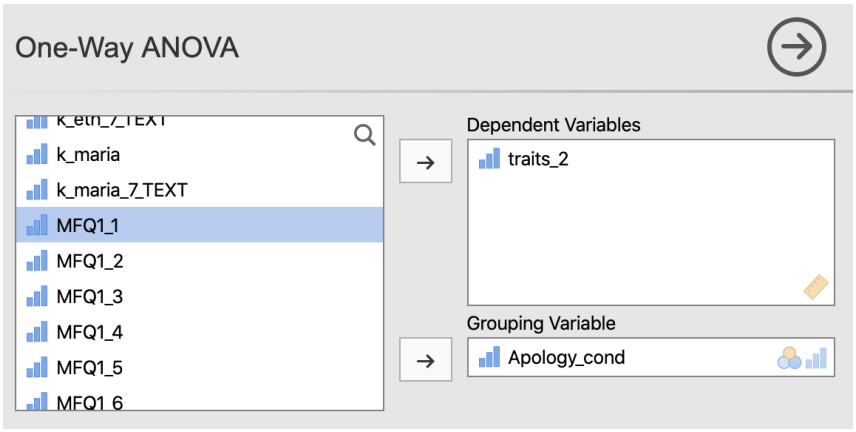
STEPS

1. **Conduct a One Way ANOVA**
   a. Open Jamovi datafile for this dataset.
   b. Go to the 'Analyses' tab.
   c. Click on ANOVA and select 'One-Way ANOVA'.

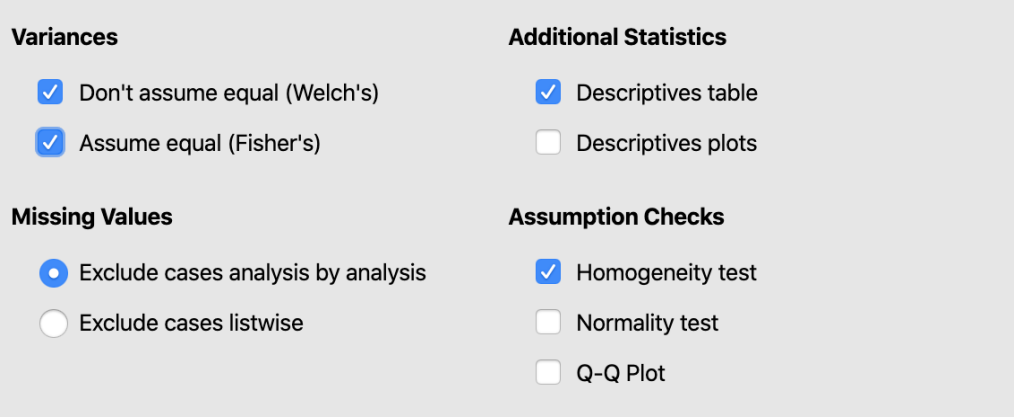


   d. Select the variable 'traits_2' and move it into the 'Dependent variable window.
   e. Select the variable 'Apology_cond' and move it into the 'grouping variable':



   f. Below the variable windows you may specify the statistics you would like Jamovi to carry out.
   g. Under 'Variances' select both 'Don't assume equal (Welch's)' and 'Assume Equal (Fisher's)'. This will ensure that an F test is carried out when either variances of the three groups are found to be unequal or equal.
   h. Then select 'Descriptives table' under 'Additional Statistics'.

i. Then under the ‘Assumption Checks’ section select 'Homogeneity test’, this tests whether the variance of the three groups are similar or not.

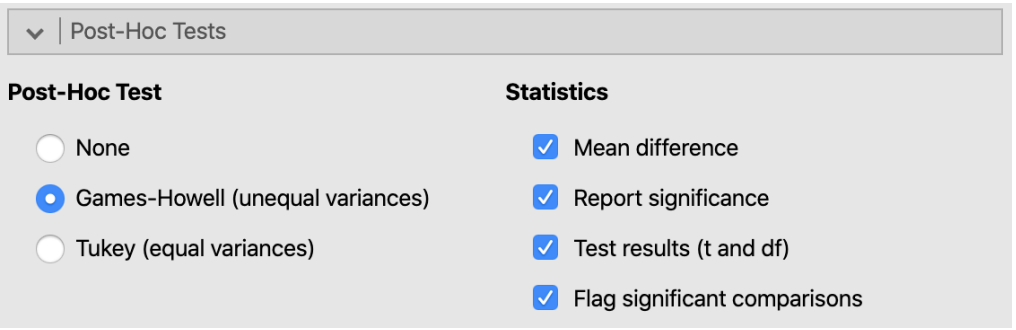


2. Selecting contrast analysis

a. Click on the arrow to the left of Post-Hoc Tests to open up options for contrast testing: 

b. Under ‘Post-Hoc Tests’ select the type of test you would like to use:
   i. If the homogeneity test indicated unequal variances choose ‘Games-Howell (unequal variance)’
   ii. If the homogeneity test indicated equal variances choose ‘Tukey (equal variance)’

c. Under ‘Statistics’ check all the boxes:



3. Interpreting the results

a. This is the Jamovi output that is produced:

Post Hoc Tests

Games-Howell Post-Hoc Test – traits_2

		Apology 1	Apology 2	Apology 3
Apology 1	Mean difference	—	–0.320	–0.474 *
	t-value	—	–1.99	–2.582
	df	—	110	99.6
	p-value	—	0.118	0.030
Apology 2	Mean difference		—	–0.154
	t-value		—	–0.769
	df		—	112.9
	p-value		—	0.723
Apology 3	Mean difference			—
	t-value			—
	df			—
	p-value			—

Note. * p < .05, ** p < .01, *** p < .001

b. Interpreting the Post Hoc Tests

i. Look for any values with asterisks '*' or '**' or '***', as per the note below the table * indicates p<.05, ** indicates p< .01, and *** indicates p-value <.001

ii. The values with asterisks indicate a statistically significant difference between the two means compared.

iii. In the table above this means that there is a statistically significant difference between mean levels of warmth attributed to Kathy by those in the no apology (Apology_1) condition and those in the full apology (Apology_3) condition. (Look at the variable labels in the first column and the first row to figure out which two means are being compared).

iv. The test reports a mean difference (e.g., M_1 - M_3), t-value or t statistics for the test conducted, degrees of freedom (df) for the test and a p-value. So for the statistically significant test found Mean Difference = -0.474, t = -2.582, df = 99.6, p = .03.

v. To find the exact value of the two means this test is referring to, look at the descriptives table produced by the One Way ANOVA, the two sample means that are statistically significantly different are M_1 = 1.43 and M_3 = 1.90.

4. APA format describing the findings:

To report results of planned or post-hoc contrasts you must first include results of the One Way ANOVA, so…

An effect of the type of apology was found such that $F(2, 114) = 4.06$, $p<.05$. Thus suggesting that type of apology affected the level of warmth attributed to Kathy. Thus, average warmth in the no apology condition was $M = 1.43$, $SD = 0.76$, average warmth in the half apology condition was $M = 1.75$, $SD = 0.97$, and average warmth in the full apology condition was $M = 1.90$, $SD = 1.20$. Post-hoc contrasts indicated that the effect was driven by the difference between the no apology condition and the full apology condition, $t(99.6) = -2.58$, $p < .05$.

----------END TUTORIAL----------

This Jamovi tutorial is a companion to a video tutorial and these materials were developed by:

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