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Tutorial 19: Paired Samples t-test

Description

In this tutorial we will learn how to conduct a paired samples t-test (also known as a repeated-measures or within-subject t test). This test is typically used when we want to compare participant scores on two measures or if we are concerned with measuring the same participants on the same measure but at two time points. Let's say we want to test whether there is a difference in scores on two measures that were collected from the same sample of participants (X_A - X_B = X_D = difference score) then we are testing whether the mean of all the difference scores (μ_D) is equal or different from zero. Our hypothesis will be a two-tailed test represented as:

$H_0: \mu_D = 0$

$H_a: \mu_D \neq 0$ (note: the alternative hypothesis H_a can also be denoted as H_1)

This table outlines all the possible hypotheses that can be tested by an independent samples t test:

Two-tailed test	One-tailed test	One-tailed test
$H_0: \mu_D = 0$	$H_0: \mu_D \leq 0$	$H_0: \mu_D \geq 0$
$H_a: \mu_D \neq 0$	$H_a: \mu_D > 0$	$H_a: \mu_D < 0$

Note: we are using the datafile ARMF2020_wave1andwave2.omv

For this tutorial we will examine the question whether participants reported different levels of disgust when asked about their own feelings compared to when asked about the victim's (Maria's) feelings. So the two measures we are investigating are:
k_disgust: I feel disgusted by Kathy's actions
m_disgust: I think Maria felt disgusted in the situation
Participants' responses ranged from 1 = Strongly disagree to 7 = Strongly agree.

The difference score we are interested in is:
$X_D = X_A - X_B$, where
  X_A: Scores on the k_disgust variable in response to "I feel disgusted by Kathy's actions"
  X_B: Scores on the m_disgust variable in response to "I think Maria felt disgusted in the situation"
Again the hypothesis we are testing is whether the mean of the difference scores X_D is different

from 0.

$H_0: \mu_D = 0$

$H_a: \mu_D \neq 0$

Data structure (One Group of Participants with two scores of a repeated measure)

Subsample of data being tested

| Participant ID	k_disgust	m_disgust
P1	6	6
P2	7	4
P3	4	4
P4	6	5
P5	6	3

Note. *t tests in Jamovi will only work with ordinal or continuous variables. If your variable is identified as nominal or ordinal/text Jamovi will not allow you to select it for a t test. So before beginning please make sure that the variable you are interested in is ordinal (integer) or continuous.*

Content

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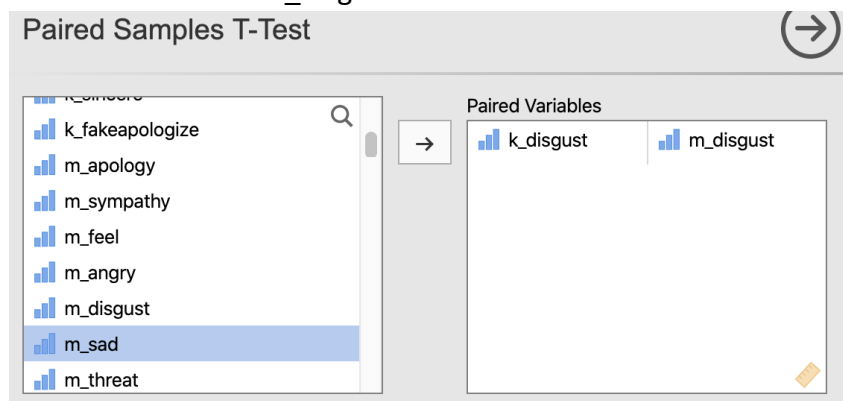4. **APA Format describing the findings**

STEPS

1. **Selecting the test and variables**
   a. Open Jamovi datafile for this dataset.
   b. Go to the 'Analyses' tab.
   c. Click on T-Tests and select 'Paired Samples T Test'.
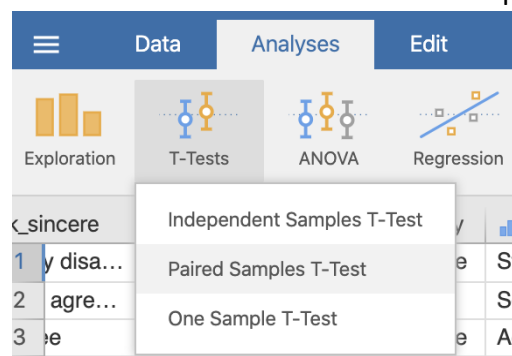
d. Select the variable 'k_disgust' and move it into the 'Paired variables' window.
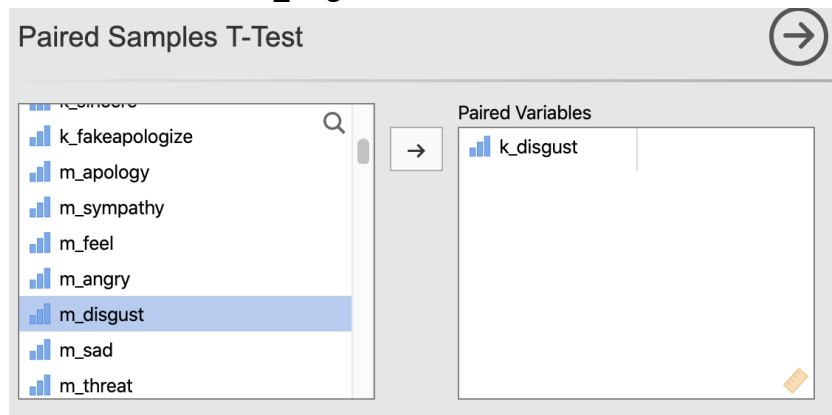
e. Select the variable 'm_disgust' and move it into the 'Paired Variables' window:

2. Selecting the statistics

a. Below the variable windows you may specify the hypothesis you are testing and select the statistics you want reported in the output window on the right.

b. First select the hypothesis by going to the Hypothesis section and selecting Measure 1 ≠Measure 2. This is the alternative hypothesis we would expect for our two tailed hypothesis.
   Note. if you were conducting a one-tailed test you would select one of the other two options: Measure 1 <Measure 2, or Measure 1 >Measure 2

c. Then select any additional statistics you would like reported, typically these include:
   i. Effect size - provides you with Cohen's d
   ii. Descriptives -provides you with the sample size, mean, median, standard deviation, and standard error

Tests

☑ Student's

☐ Bayes factor

Prior 0.707

☐ Wilcoxon rank

Hypothesis

⦿ Measure 1 ≠ Measure 2

◯ Measure 1 > Measure 2

◯ Measure 1 < Measure 2

Missing values

⦿ Exclude cases analysis by analysis

◯ Exclude cases listwise

Additional Statistics

☐ Mean difference

☐ Confidence interval   95   %

☑ Effect size

☐ Confidence interval   95   %

☑ Descriptives

☐ Descriptives plots

Assumption Checks

☐ Normality test

☐ Q-Q Plot

3. Interpreting the results

   a. This is the Jamovi output that is produced:

Paired Samples T-Test

Paired Samples T-Test

			statistic	df	p		Effect Size
k_disgust	m_disgust	Student's t	3.10	179	0.002	Cohen's d	0.231

Descriptives

	N	Mean	Median	SD	SE
k_disgust	180	5.83	6.00	1.24	0.0925
m_disgust	180	5.53	6.00	1.21	0.0903

   b. Interpreting the paired samples t test table

      i. Provides a t- statistic under 'Statistic'

      ii. degrees of freedom under 'df'

      iii. p-value under 'p'

      iv. provides Cohen's d as the effect size under 'Effect Size'

      v. We can conclude if our null hypothesis $H_0:\mu_D = 0$, should be rejected or

         retained by observing the p-value in the Paired Samples T Test table, if the p-value is less than .05 then we reject the null hypothesis but if p-value is >.05, then we retain the null hypothesis. In our case p = .002 which is less

than .05 then we reject the null hypothesis and conclude that the mean difference score μ_D is different from zero. So we can conclude that there is a difference between how participants attribute feelings of disgust to the victim and how disgusted they themselves feel about what Kathy did.

vi. Because the mean difference in scores was statistically different from zero then we need to report the effect size of that difference. So you must report Cohen's d. Interpreting Cohen's d, values of around 0.20 are considered small effects, values around 0.50 are considered medium effects, values around 0.80 or greater are considered large effects.

c. Interpreting the descriptives table

   i. The descriptives provide us with the means for each measure, $M_{k\_disgust}$ = 5.83 and $M_{m\_disgust}$ = 5.53 as well as the respective standard deviations which should be used in reporting the findings. These show that participants are reporting higher feelings of disgust about what Kathy did, for themselves than for the victim (Maria).
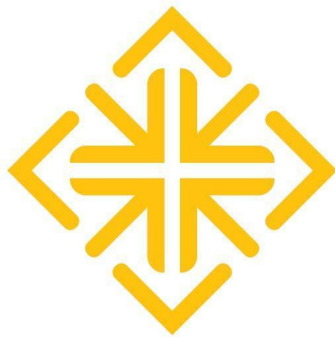
4. **APA format describing the findings:**

   A paired samples *t* test was conducted to compare differences in participants reported feelings of disgust about Kathy's actions, when attributed to one's self or when attributed to the victim (Maria). Findings indicated that there was a difference between feelings of disgust when attributed to one's self compared to when attributed to the victim, $t(179) = 3.10$, $p = .002$, Cohen's d = 0.23. Participants attributed more feelings of disgust to themselves (*M* = 5.67, *SD* = 1.24) compared to the victim (*M* = 5.83, *SD* = 1.21).

   --END TUTORIAL--

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

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