

## Assignment 8: Within-Subjects T-Test vs. Between-Subjects T-Test

Due: Wednesday, November 19<sup>th</sup> on Canvas

### Part 1: Within-Subjects T-Test

**Within-subjects:** each participant completes both conditions; each person serves as his/her own control  
-Samples are Dependent or Paired

(1) Open "Assignment8\_DataFile" in SPSS

--Go to "Variable View" and assure all data is "Type: Numeric"

--Note: each row represents 1 participant

--You should have 4 columns for each participant:

(a) Condition

-1 = Interference / Control

-2 = Control / Interference

(b) Section

-1 = 9am

-2 = 3pm

(c) Interference

-how long it takes in the right-side-up condition

-time should be in seconds

(d) Control

-how long it takes in the upside-down condition

-time should be in seconds

(2) Click "Analyze" → Click "Compare Means" → Click "Paired-Samples T-Test"

(a) Move "Interference" over into Variable 1

(b) Move "Control" over into Variable 2

(c) Click "Options"

→ Assure that the "Confidence Interval Percentage" is set to 95%

→ Click "Continue"

→ Click "OK"

(3) SPSS Output

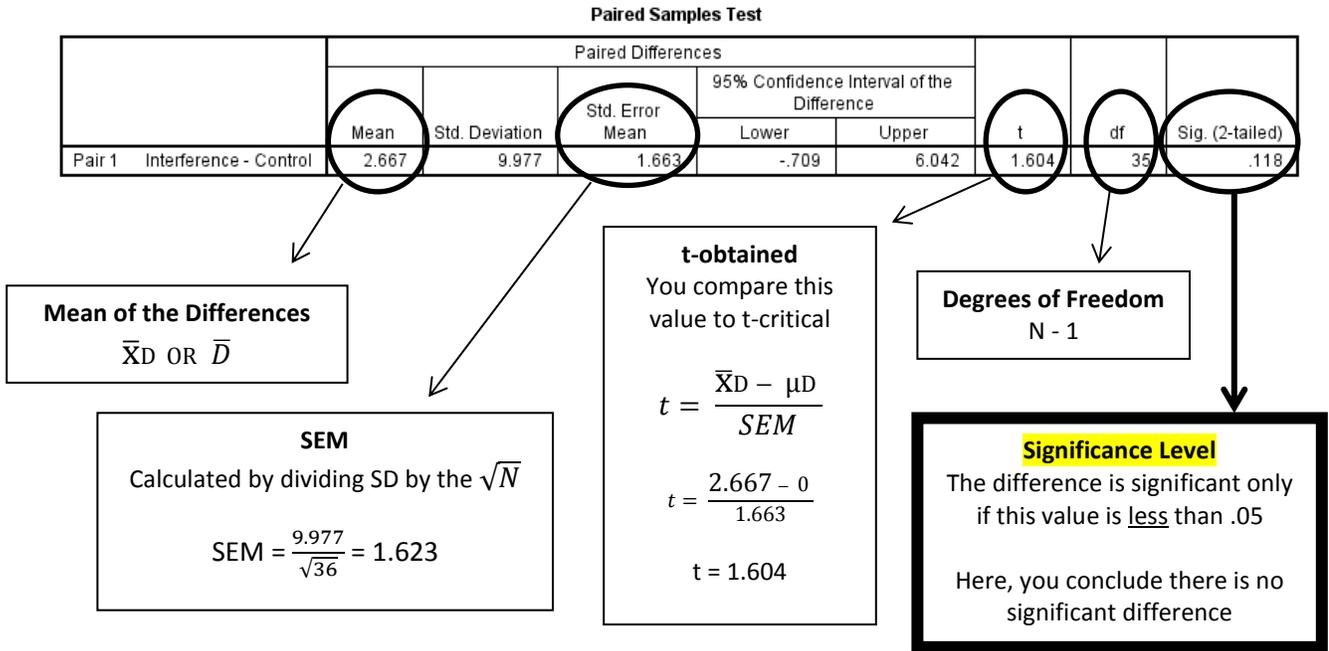
→ You should get 3 tables:

(a) Paired-Samples Statistics

(b) Paired-Samples Correlations

(c) Paired-Sample Test

(4) Within-Subjects Interpretation



**Note:** Is there a significant difference between conditions? Simply look at the *Significance Level* (i.e., “Sig. (2-tailed)”) and compare it to your alpha value, which in most cases is .05. The Significance Level tells you the probability that the difference observed between conditions (interference mean – control mean = 2.667) is due to chance. If the probability is less than .05, then we decide to reject the null hypothesis. If we reject the null, we conclude that there is a significant difference between the 2 conditions. The other information (i.e., Mean, SD, SEM, *t*, *df*) is reported so you can report it in a research paper and so have a more complete idea as to what is going on between groups.

**[The next 3 steps (5-7) demonstrate by performing a One-Sample T-test on the difference scores (Condition 1-Condition 2, you get the exact same results as a Paired-Sample T-test)]**

- (5) Click “Transform” → Click “Compute Variable”  
 -Fill in “Target Variable” as *Difference Scores*  
 -Numeric Expression: “Interference – Control”  
 → Click “OK”

-Note: A new column labeled “Difference Scores” will appear in the spreadsheet

(6) Now, you will perform a One Sample T-Test on the Difference Scores to demonstrate that what a Within-Subjects T-Test is showing. You are basically testing whether the average difference score is significantly different from 0.

- Click “Analyze” → Click “Compare Means” → Click “One Sample T-Test”
- Move “Difference Scores” over into “Test Variable(s)”
- Set Test Value to 0

- (7) You will get 2 Output Tables  
 (a) One-Sample Statistics  
 (b) One-Sample Test

→ Observe the output values and compare to the Paired-Samples T-Test. They should be identical. Take home: Paired-samples T-test is just like a One-Sample T-test, except it is performed on the difference scores.

## Part 2: Independent Means T-Test

Using the same data file as in Part 1, you will now ask a different research question. The Paired-Samples T-test assessed whether there was a difference between conditions (interference vs. control). However, now you want to assess whether there was an effect of order. Said another way, does the order in which you complete the 2 conditions matter? It is possible that practice or fatigue effects produce these order effects.

→ This analysis requires an Independent-Means T-Test

- Between-subjects:** you have 2 separate groups of participants and you compare them to each other
  - samples are Independent
  - this test will usually be less sensitive (i.e., will have less statistical power) than a dependent means t-test, but in instances like these, it is more appropriate given our question

- (1) Click “Analyze” → Click “Compare Means” → Click “Independent-Samples T-Test”
  - Move only “Interference” to “Test Variables”
  - Move “Condition” to “Grouping Variable”
  - Click “Define Groups...”
    - Group 1: 1
    - Group 2: 2
  - Click “Continue” → “OK”

### T-Test

[DataSet0] C:\Users\jess\Desktop\Assignment8\_DataFile.sav

Condition	N	Mean	Std. Deviation	Std. Error Mean
Interference 1	18	36.61	11.392	2.685
Interference 2	18	32.56	10.711	2.525

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Interference	Equal variances assumed	.384	.539	1.100	34	.279	4.056	3.686	-3.435	11.546
	Equal variances not assumed			1.100	33.871	.279	4.056	3.686	-3.436	11.547

→ Look at the Sig. (2-tailed value) – is it less than .05?

- (3) Click “Analyze” → Click “Compare Means” → Click “Independent-Samples T-Test”
  - Move only “Control” to “Test Variables”
  - Move “Condition” to “Grouping Variable”
  - Click “Define Groups...”
    - Group 1: 1
    - Group 2: 2
  - Click “Continue” → “OK”

### T-Test

[DataSet0] C:\Users\jess\Desktop\Assignment8\_DataFile.sav

Condition	N	Mean	Std. Deviation	Std. Error Mean
Control 1	18	30.50	13.263	3.126
Control 2	18	33.33	11.077	2.611

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Control	Equal variances assumed	.113	.739	-.696	34	.491	-2.833	4.073	-11.111	5.444
	Equal variances not assumed			-.696	32.955	.492	-2.833	4.073	-11.120	5.454

→ Look at the Sig. (2-tailed value) – is it less than .05?

- (4) Click “Analyze” → Click “Compare Means” → Click “Independent-Samples T-Test”  
 → Move only “Difference Scores” to “Test Variables”  
 → Move “Condition” to “Grouping Variable”  
 → Click “Define Groups...”  
 → Group 1: 1  
 → Group 2: 2  
 → Click “Continue” → “OK”

• T-Test

[DataSet0] C:\Users\jess\Desktop\Assignment8\_DataFile.sav

Group Statistics

Condition	N	Mean	Std. Deviation	Std. Error Mean
Difference 1	18	6.1111	10.45938	2.46530
Difference 2	18	-.7778	8.39156	1.97791

Independent Samples Test

		Levene's Test for Equality of Variances		t-Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Difference	Equal variances assumed	.238	.629	2.180	34	.036	6.88889	3.16067	.46564	13.31214
	Equal variances not assumed			2.180	32.488	.037	6.88889	3.16067	.45450	13.32328

→ Look at the Sig. (2-tailed value) – is it less than .05?

## Assignment 8: What to hand in?

### Tables from Part 1:

- (a) Paired Samples Statistics on Interference vs. Control
- (b) Paired Samples Correlations on Interference vs. Control
- (c) Paired Sample Test on Interference vs. Control
- (d) One-Sample Statistics on Difference Scores
- (e) One-Sample Test on Difference Scores

### Tables from Part 2:

- (a) Group Statistics on Interference
- (b) Independent Samples T-Test on Interference
- (c) Group Statistics on Control
- (d) Independent Samples T-Test on Control
- (e) Group Statistics on Difference Scores
- (f) Independent Samples T-Test on Difference Scores

### Follow-up questions:

(1) Paired-Sample T-test

→ What were the degrees of freedom used in the *Paired-Sample T-Test*: \_\_\_\_\_

→ What was the significance level for the *Paired Sample T-Test on Interference vs Condition*: \_\_\_\_\_

(2) Independent-Sample T-test

→ What were the degrees of freedom used in the *Independent-Sample T-Test*: \_\_\_\_\_

→ What was the significance level for the *Independent Sample T-Test on Interference*: \_\_\_\_\_

→ What was the significance level for the *Independent Sample T-Test on Control*: \_\_\_\_\_

→ What was the significance level for the *Independent Sample T-Test on Difference Scores*: \_\_\_\_\_

(3) Why are the degrees of freedom different in the Paired-Sample T-Test and the Independent-Sample T-Test?

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(4) Were any of the t-test significant? \_\_\_\_\_

-If yes, which one(s): \_\_\_\_\_

(5) I want to compare performance between the 9am section and the 3pm section.

(a) Is this between-subjects or within-subjects? \_\_\_\_\_

(b) Which procedure would I run in SPSS? \_\_\_\_\_