

PSY 3020 – Two Group t Tests

- Agenda
 - two group experiments
 - Independent Samples t Test
 - Paired Samples t Test
- SPSS & JASP
 - When entering data, one participant per row.

Two Group Experiments

- Independent Samples t Test
 - Use this test to compare scores for two separate groups of participants that are not matched in any way. These are typically an experimental and control group.
- Paired Samples t Test
 - Use this test to compare scores for either matched groups of participants or repeated measures designs where the same people are tested before and after a treatment.

Tests for means that come from separate groups of observations.

Note: in SPSS for a one-tailed test, divide your sig by 2.

$df = n_1 + n_2 - 2$

INDEPENDENT GROUPS

Independent Groups t Problem:

Schmidt (1994) studied the effects of humor on memory. Humorous & non humorous same sentences presented to two groups. Recall data is in the following table.

- a. Does humor have a significant effect on memory? Two-tailed test, $\alpha = .05$.
- b. Calculate r^2 , variance explained by the treatment.

Humor & Memory

Number of Sentences Recalled							
Humorous Sentences				Nonhumorous Sentences			
4	5	2	4	5	2	4	2
6	7	6	6	2	3	1	5
2	5	4	3	3	2	3	3
3	3	5	3	4	1	5	3

Assumptions Independent Samples t

- Random Sampling
 - All individuals in the population of interest have an equal chance of being selected.
- Independence
 - Each value is sampled independently from each other value. Typically, each subject provides one value.
- Data are Normally Distributed
 - The distribution of error in the population of both groups should be normal.
 - Can't have much skew & kurtosis of sample data.
- Homogeneity of Variance
 - Variances of the two groups are equivalent.

Independent Samples *t* Tests in JASP

The screenshot shows the JASP interface. On the left is a data table with 20 rows and 2 columns: 'Type' and 'Score'.

	Type	Score
1	Funny	4
2	Funny	6
3	Funny	2
4	Funny	3
5	Funny	5
6	Funny	7
7	Funny	5
8	Funny	3
9	Funny	2
10	Funny	6
11	Funny	4
12	Funny	5
13	Funny	4
14	Funny	6
15	Funny	3
16	Funny	3
17	Not Funny	5
18	Not Funny	2
19	Not Funny	3
20	Not Funny	4

On the right is the 't Test Humor and Memory' configuration window. The 'Dependent Variables' section has 'Score' selected. The 'Grouping Variable' section has 'Type' selected. Under 'Hypothesis', 'Group 1 ≠ Group 2' is selected. Under 'Additional Statistics', 'Effect size' and 'Descriptives' are checked. The 'Interval' is set to 95%.

T-Test ▾

Independent Samples T-Test

	t	df	p	Cohen's d
Score	2.479	30.00	0.019	0.877

Note. All tests, variances of groups assumed equal

Group Descriptives ▾

	Group	N	Mean	SD	SE
Score	Funny	16	4.250	1.528	0.382
	Not Funny	16	3.000	1.317	0.329

$$r^2 = \frac{2.479^2}{2.479^2 + 30} = .170$$

An independent samples *t* test showed that participants in the funny condition ($M = 4.25$, $SD = 1.53$) recalled significantly more sentences than participants in the not-funny condition ($M = 3.00$, $SD = 1.32$), $t(30) = 2.479$, $p = .019$, $r^2 = .170$, 2-tailed.

PSY 3020 Jeans Data

- Number of jeans for two independent groups of participants.
- Perform a two-tailed t test, with $\alpha = .05$, to test for a difference between groups. Report in APA format.

Section 5 (Fall, 2014)											
4	5	2	10	20	4	8	4	3	12	8	20
4	10	5	15	6	10	9	10	4	6	5	
Section 11 (Fall, 2012)											
25	3	15	10	7	8	15	7	10	8	8	5
6	7	3	20	15	15	18	5	12	30		

Independent Groups t Test in JASP

	Section	Jeans
17	F14	6
18	F14	10
19	F14	9
20	F14	10
21	F14	4
22	F14	6
23	F14	5
24	F12	25
25	F12	3
26	F12	15
27	F12	10
28	F12	7
29	F12	8
30	F12	15

The screenshot shows the JASP 't Test: Independent Groups' dialog box. The 'Dependent Variables' field contains 'Jeans'. The 'Grouping Variable' field contains 'Section'. Under 'Hypothesis', 'Group 1 = Group 2' is selected. Under 'Additional Statistics', 'Effect size', 'Confidence interval', 'Descriptives', 'Normality tests', and 'Descriptives plots' are checked. The confidence interval is set to 95%.

APA Format

T-Test

Independent Samples T-Test

	t	df	p	Cohen's d
Jeans	1.902	43.00	0.064	0.567

Note. All tests, variances of groups assumed equal

Group Descriptives

	Group	N	Mean	SD	SE
Jeans	F12	22	11.455	7.069	1.507
	F14	23	8.000	4.982	1.039

An independent samples t test showed that the number of pairs of jeans for Fall 2012 ($M = 11.5$, $SD = 7.1$) was not significantly different than for Fall 2014 ($M = 8.0$, $SD = 5.0$), $t(43) = 1.902$, $p = .064$, $d = 0.567$.

Tests for means that come from strongly related groups, such as pretests & post-tests on the same people (repeated measures) or tests of pairs that are matched.

$df = \# \text{ pairs} - 1$

Note: in SPSS for a one-tailed test, divide your sig by 2.

PAIRED (CORRELATED) SAMPLES

Paired Samples t Test in JASP

- A single group of participants completed the WAIS Forward and backward digit span tests.
- Perform a hypothesis test with t to determine if their FWD span was greater than their BWD span, $\alpha = .05$, one-tailed.

Participant	Digits FWD	Digits BWD
1	6	6
2	9	6
3	7	6
4	8	8
5	7	6
6	5	5
7	7	6
8	11	8
9	8	7
10	7	6
11	5	5
12	7	7
13	7	5
14	7	7
15	6	5
16	7	5
17	6	5
18	5	7
19	8	6
20	5	6
21	8	7
22	9	5
23	6	5
24	10	7
25	7	7
26	7	7
27	6	5
28	8	8
29	9	7

The screenshot displays the JASP software interface for a Paired Samples t Test. On the left, a data table shows the following data:

	Participant	Digits FWD	Digits BWD
1	1	6	6
2	2	9	6
3	3	7	6
4	4	8	8
5	5	7	6
6	6	5	5
7	7	7	6
8	8	11	8
9	9	8	7
10	10	7	6

The right panel shows the configuration for the t Test Paired Samples Digit Span. The 'Common' tab is active, showing the variables 'Participant', 'Digits FWD', and 'Digits BWD'. The 'Hypothesis' section has 'Measure 1 > Measure 2' selected. The 'Additional Statistics' section has 'Effect size', 'Confidence interval' (95%), 'Descriptives', 'Normality tests', and 'Descriptives plots' checked.

T-Test ▼

Paired Samples T-Test

			t	df	p	Cohen's d
Digits FWD	-	Digits BWD	4.015	28	< .001	0.746

Note. All tests, hypothesis is measurement one greater than measurement two

Descriptives ▼

	N	Mean	SD	SE
Digits FWD	29	7.172	1.490	0.277
Digits BWD	29	6.207	1.013	0.188

$$r^2 = \frac{4.015^2}{4.015^2 + 28} = .366$$

A paired samples *t* test showed that forward digit span ($M = 7.17$, $SD = 1.49$) was significantly higher than backward digit span ($M = 6.21$, $SD = 1.01$), $t(28) = 4.015$, $p < .001$, $r^2 = .366$, 1-tailed.

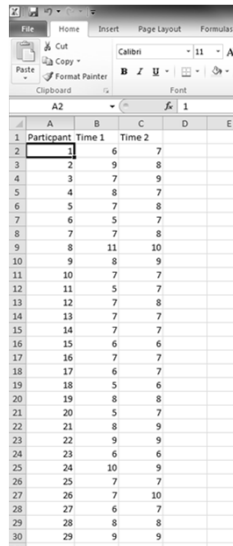
You Try It...

- A single group of participants completed the WAIS Forward and digit span test two times, one month apart.
- Perform a hypothesis test with *t* to determine if their span differed across test dates, $\alpha = .05$, two tail.

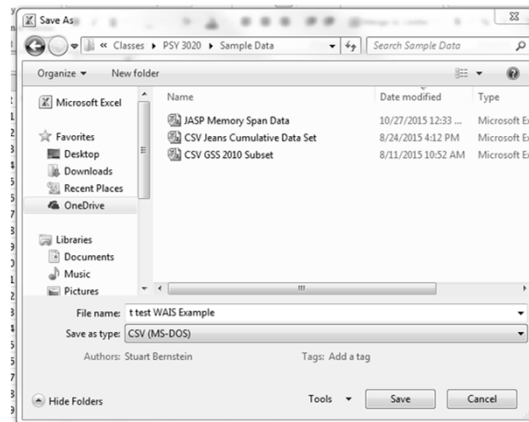
Participant	Time 1	Time 2
1	6	7
2	9	8
3	7	9
4	8	7
5	7	8
6	5	7
7	7	6
8	11	10
9	8	9
10	7	7
11	5	7
12	7	8
13	7	7
14	7	7
15	6	6
16	7	7
17	6	7
18	5	6
19	8	8
20	5	7
21	8	9
22	9	9
23	6	6
24	10	9
25	7	7
26	7	10
27	6	7
28	8	8
29	9	9

Creating Files in Excel for JASP

Save As: CSV format

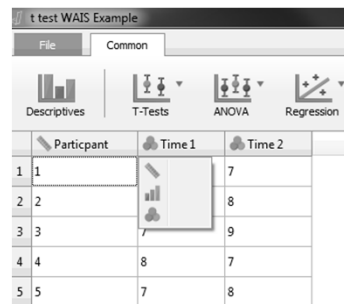


	A	B	C	D	E
1	Participant	Time 1	Time 2		
2	1	6	7		
3	2	9	8		
4	3	7	9		
5	4	8	7		
6	5	7	8		
7	6	5	7		
8	7	7	8		
9	8	11	10		
10	9	8	9		
11	10	7	7		
12	11	5	7		
13	12	7	8		
14	13	7	7		
15	14	7	7		
16	15	6	6		
17	16	7	7		
18	17	6	7		
19	18	5	6		
20	19	8	8		
21	20	5	7		
22	21	8	9		
23	22	9	9		
24	23	6	6		
25	24	10	9		
26	25	7	7		
27	26	7	10		
28	27	6	7		
29	28	8	8		
30	29	9	9		



Opening File in JASP

- Be sure your numbers are identified as scale variables.
- Re-save your file after the scales are identified.



	Participant	Time 1	Time 2
1	1		7
2	2		8
3	3		9
4	4	8	7
5	5	7	8

APA Format Sentence

T-Test ▼

Paired Samples T-Test

			t	df	p	Cohen's d
Time 2	-	Time 1	2.911	28	0.007	0.541

Descriptives

	N	Mean	SD	SE
Time 2	29	7.724	1.131	0.210
Time 1	29	7.172	1.490	0.277

A paired samples t test showed that WAIS digits forward scores at time 2 ($M = 7.7$, $SD = 1.1$) were significantly different than scores at time 1 ($M = 7.2$, $SD = 1.5$), $t(28) = 2.911$, $p = .007$, $d = 0.541$, two-tailed.

Assumptions Paired Groups t Test

- Normality

- Shapiro-Wilk. H_0 : normality. You want to FAIL to reject. If $p < .05$, violation of normality.

Test of Normality (Shapiro-Wilk)			
		W	p
Jeans	F12	0.897	0.026
	F14	0.858	0.004

Note. Significant results indicate a deviation from normality

- Homogeneity (Equality) of Variance

- Levene's test, H_0 : equal variances. You want to FAIL to reject. If $p < .05$, violation of homogeneity.

Test of Equality of Variances (Levene's)			
	F	df	p
Jeans	2.794	1	0.102

Summary: 3 t Tests

Each is calculated very differently.

- Single Sample t Test
- Independent Groups t Test
- Paired (Correlated) Groups t Test