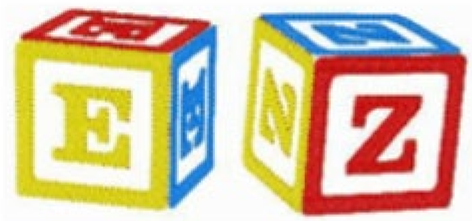


SPSS

A SIMPLE GUIDE TO USING SPSS

by

Mark A. Stellmack and Emma Estrella

Table of Contents

Descriptive Statistics

Purpose: To compute descriptive statistics (e.g., mean, standard deviation, minimum, maximum) for your variables. (Descriptive statistics are shown in the output when you run many types of inferential statistical tests, so you may not need to compute only descriptive statistics very often, but here are instructions for doing so.)

How to set up the data: Each variable should be in its own column. Each row contains data for a different subject.

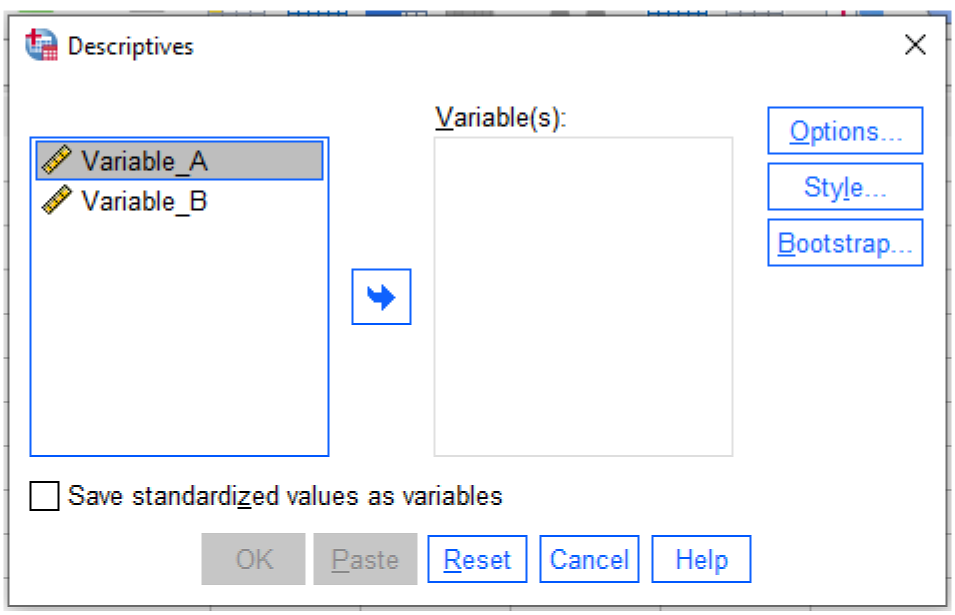
Example: Compute descriptive statistics for Variable A and Variable B.

Example data:

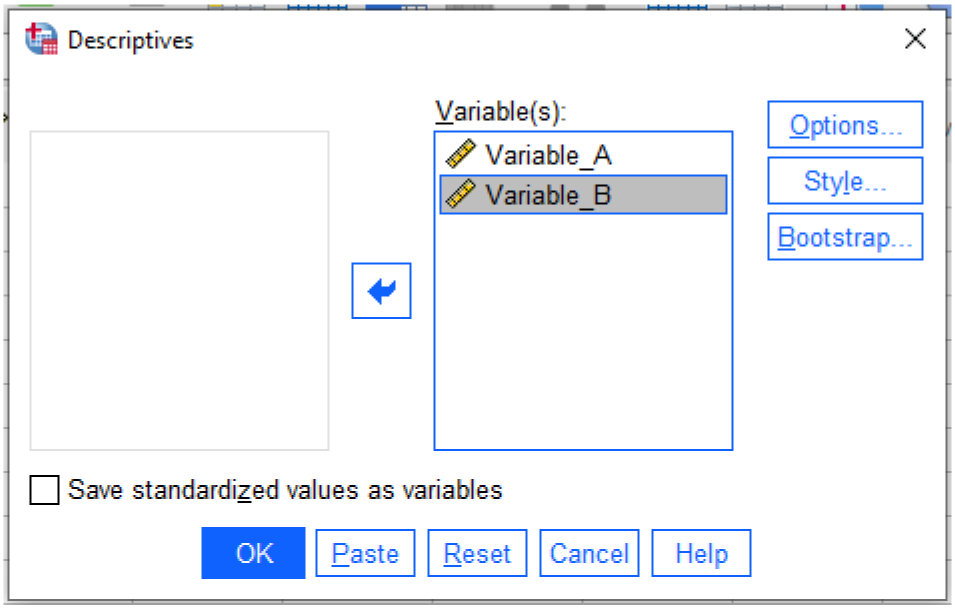
	Variable_A	Variable_B
1	3.00	12.00
2	5.00	14.00
3	7.00	16.00
4	3.00	15.00
5	8.00	11.00

How to compute descriptive statistics:

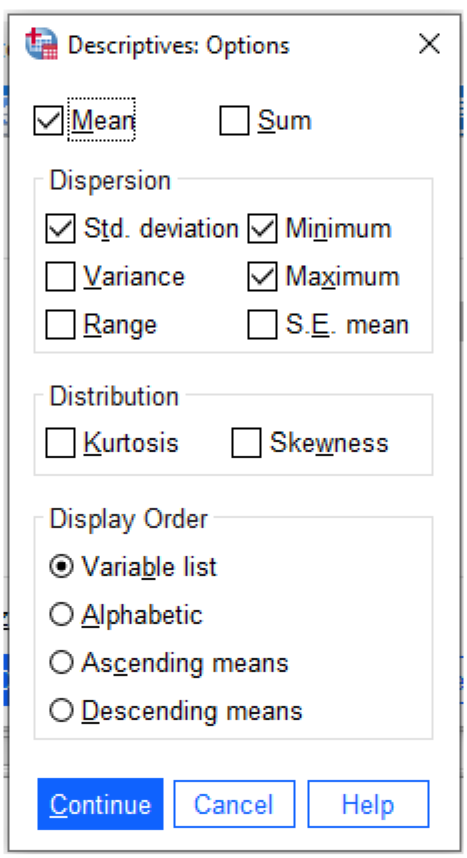
1) Click on Analyze > Descriptive Statistics > Descriptives... to open the dialog box:



2) Move the variables for which you want descriptive statistics to "Variable(s)":



3) Click "Options…" Check the boxes for the statistics you want to compute. Mean, standard deviation, minimum, and maximum are already selected by default:



4) Click “Continue”. Click “OK” in the “Descriptives” dialog box. The results will appear in the Output window.

How to read the output: Each row of the Descriptive Statistics table contains the statistics for one of the variables.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Variable_A	5	3.00	8.00	5.2000	2.28035
Variable_B	5	11.00	16.00	13.6000	2.07364
Valid N (listwise)	5				

How to report the descriptive statistics in APA format:

For this example:

For Variable A, $M = 5.20$, $SD = 2.28$.

Correlation (Pearson Product-Moment Correlation Coefficient)

Purpose: To determine the strength and direction of linear relationship between two variables. The p-value that is reported by SPSS allows you to decide whether the correlation coefficient is significantly different from zero.

How to set up the data: SPSS can compute correlations between more than two variables at one time. If you submit more than two variables to the correlation procedure, the output will show the correlations between all possible pairs of the variables. Each variable should be in a separate column, with values that belong together entered in the same row.

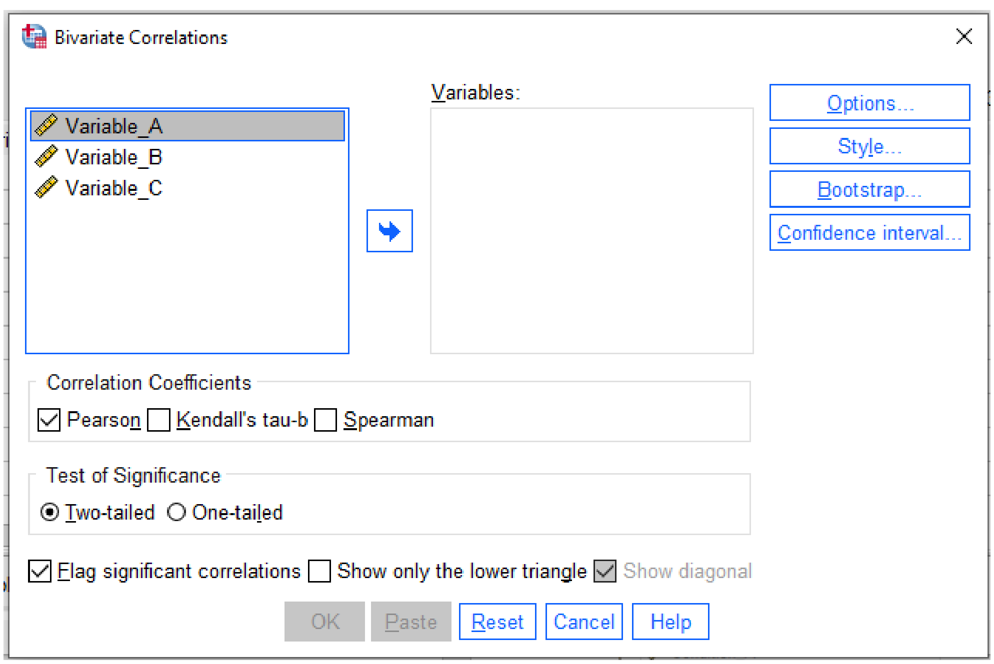
Example: Compute the correlations between Variables A and B, between Variables A and C, and between Variables B and C.

Example data:

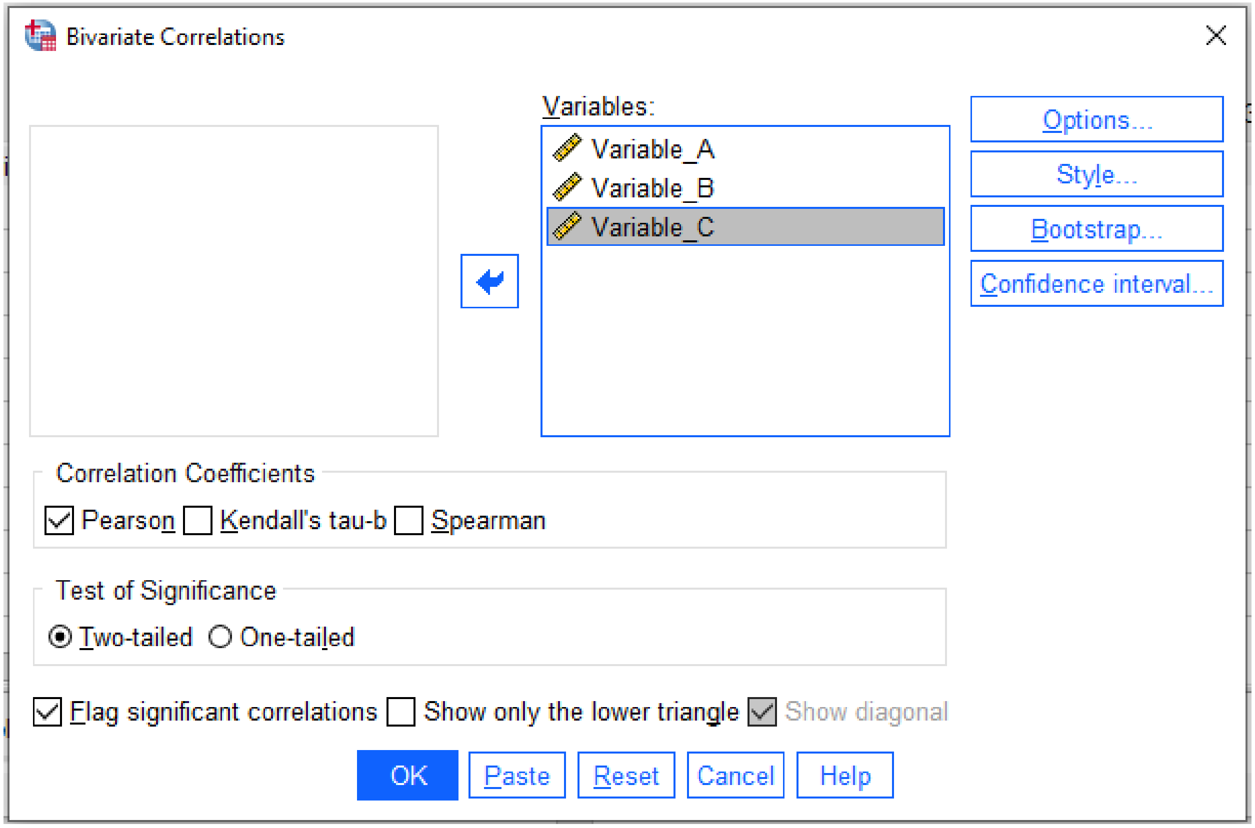
	Variable_A	Variable_B	Variable_C
1	54.00	40.00	6.00
2	35.00	31.00	4.00
3	18.00	12.00	7.00
4	12.00	9.00	5.00
5	31.00	22.00	9.00
6	26.00	20.00	2.00

How to run the test:

1) Click on Analyze > Correlate > Bivariate… The "Bivariate Correlations" dialog box appears:



2) Move all of the variables for which you want to compute correlations to the "Variables" box:



3) Click "OK". The results will appear in the Output window.

How to read the output:

The same correlation between each pair of variables is shown in two cells of the table:

Correlations

		Variable_A	Variable_B	Variable_C
Variable_A	Pearson Correlation	1	.981**	.073
	Sig. (2-tailed)		<.001	.891
	N	6	6	6
Variable_B	Pearson Correlation	.981**	1	-.042
	Sig. (2-tailed)	<.001		.936
	N	6	6	6
Variable_C	Pearson Correlation	.073	-.042	1
	Sig. (2-tailed)	.891	.936	
	N	6	6	6

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation between Variables A and B.

Correlation between Variables A and C.

Correlation between Variables B and C.

This value is N. df = N - 2.

How to report the results in APA format:

General format: $r(df) = \#.\#\#, p = .\#\#\#$

Note that the table shows N rather than df. For this test, df = N – 2.

For this example:

Correlation between A and B: $r(4) = 0.981, p < .001$

Correlation between A and C: $r(4) = 0.073, p = .891$

Correlation between B and C: $r(4) = -0.042, p = .936$

Note that the p-value reported by SPSS in the table is for a two-tailed (non-directional) test. If you want to do a one-tailed (directional) test, either choose the "One-tailed" option in the "Bivariate Correlations" dialog box, or divide the two-tailed p-value by 2 to get the correct p-value.

Independent-Samples t-test/Independent-Groups t-test

Purpose: To compare the means of two samples that contain independent observations of a variable (for example, for two different levels of an independent variable).

How to set up the data: One column should contain the variable being compared for the two groups/samples (the dependent variable, or DV). Another column should contain an identifier that indicates to which group/sample the observation belongs. Each row contains data for a different subject.

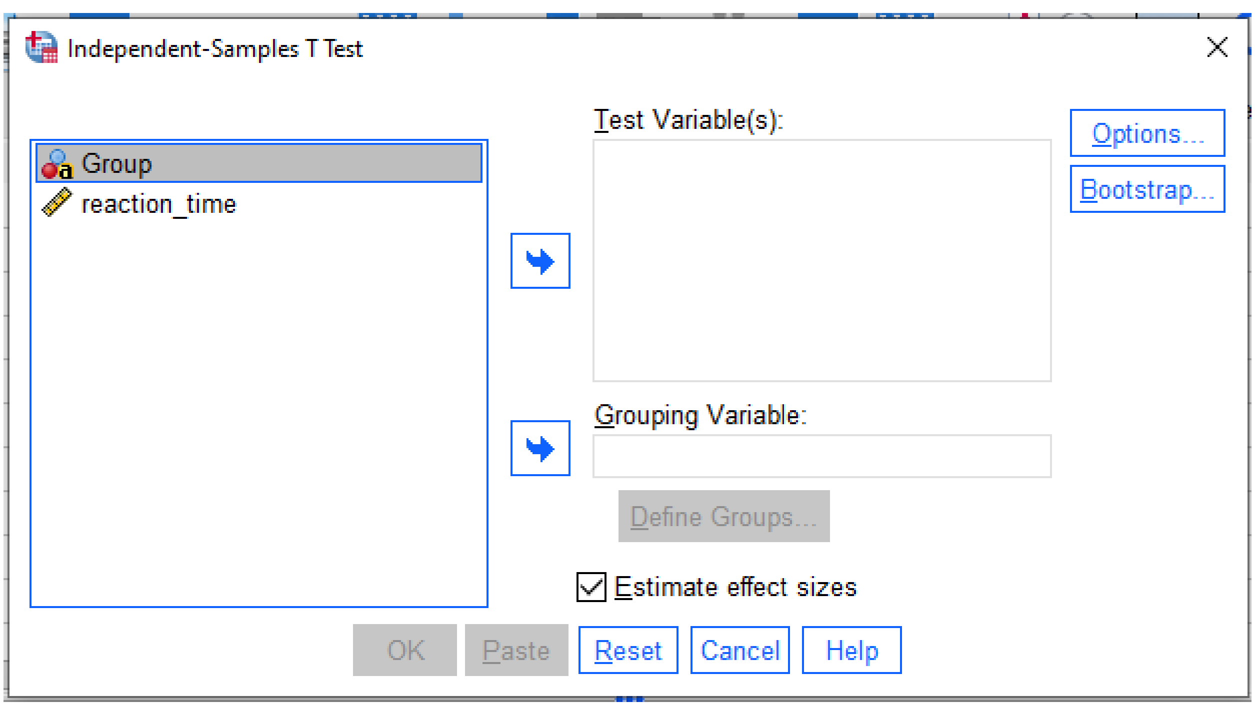
Example: Compare the mean reaction time for Group A and Group B.

Example data:

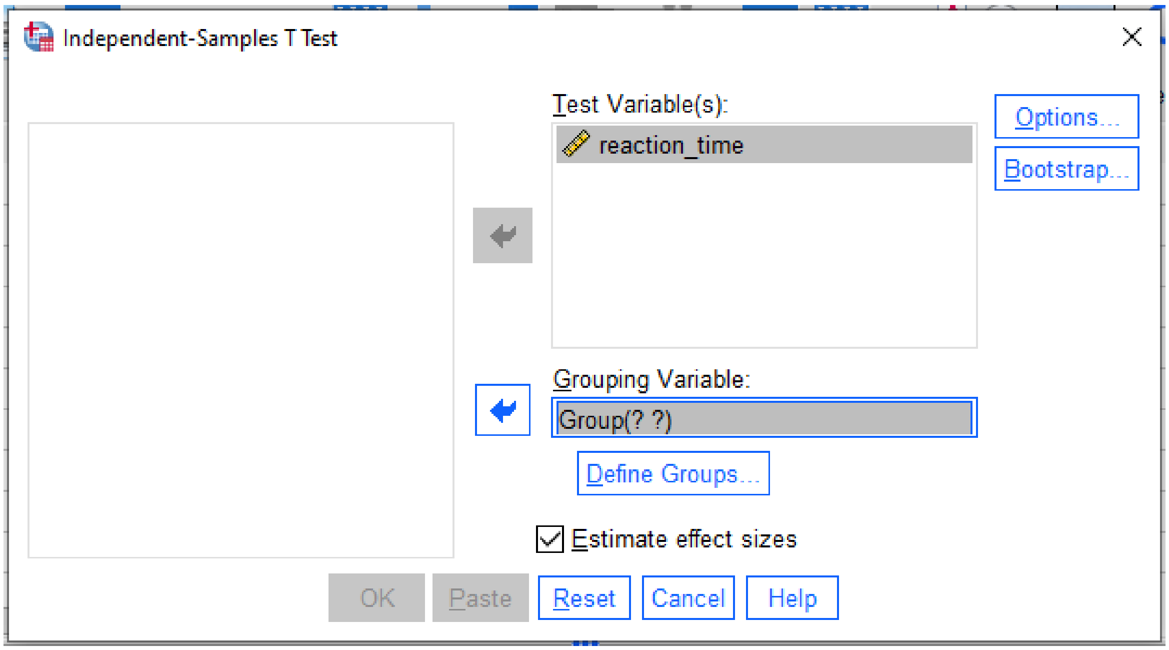
	Group	reaction_time
1	A	24.60
2	A	32.90
3	B	18.50
4	A	27.10
5	B	15.30
6	B	16.10
7	A	25.60

How to run the test:

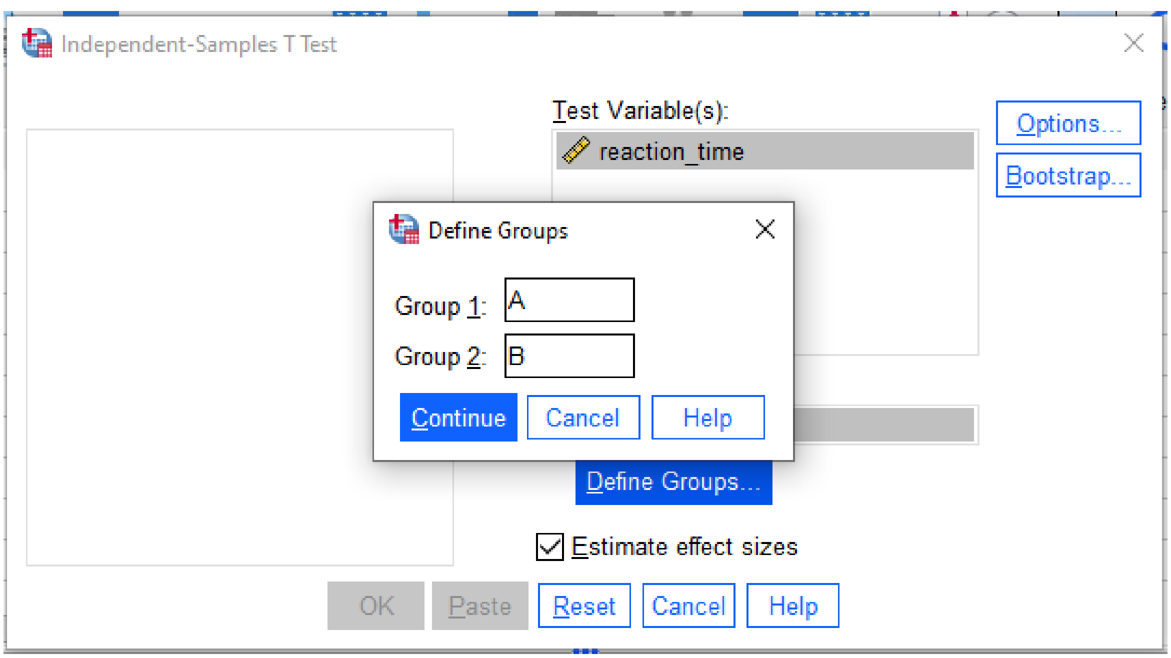
1) Click on Analyze > Compare Means > Independent-Samples T Test… to open the dialog box:



2) Move the DV to "Test Variable(s)" and move the grouping variable to "Grouping Variable". (Check the "Estimate effect sizes" box at the bottom to calculate Cohen's d):



3) Click "Define Groups..." Enter the two possible values of the grouping variable exactly as they appear in your spreadsheet (e.g., in terms of upper- and lower-case letters):



4) Click "Continue". Click "OK" in the "Independent-Samples T Test" dialog box. The results will appear in the Output window.

How to read the output:

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
reaction_time	A	4	27.5500	3.71169	1.85585
	B	3	16.6333	1.66533	.96148

This table shows the descriptive statistics for your variable in your two groups.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
reaction_time	Equal variances assumed	1.289	.308	4.668	5	.005	10.91667	2.33858	4.90516	16.92817
	Equal variances not assumed			5.223	4.356	.005	10.91667	2.09012	5.29584	16.53750

Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
reaction_time	Cohen's d	3.06192	3.565	.907	6.131
	Hedges' correction	3.64189	2.998	.762	5.155
	Glass's delta	1.66533	6.555	.757	12.737

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.

Cohen's d (effect size) is shown in this cell. In this example, Cohen's d = 3.565.

How to report the results in APA format:

General format: $t(\text{df}) = \#.\#\#, p = .\#\#\#$

For this example: $t(5) = 4.668, p = .005$

Note that the p-value reported by SPSS is for a two-tailed (non-directional) test. If you are doing a one-tailed (directional) test, you must divide the reported p-value by 2 to get the correct p-value.

Repeated-Measures t-test/Paired-Samples t-test/Related-Samples t-test

Purpose: To compare the means of two samples in which the same subjects contributed data to both samples (in a repeated-measures design) or if each subject in one group can be matched with one subject in the other group in a meaningful way (e.g., twins; brother and sister).

How to set up the data: One column should contain the values for one condition and another column should contain the values for the second condition, with values that belong together entered in the same row. In a repeated-measures design, each row contains values for a single subject.

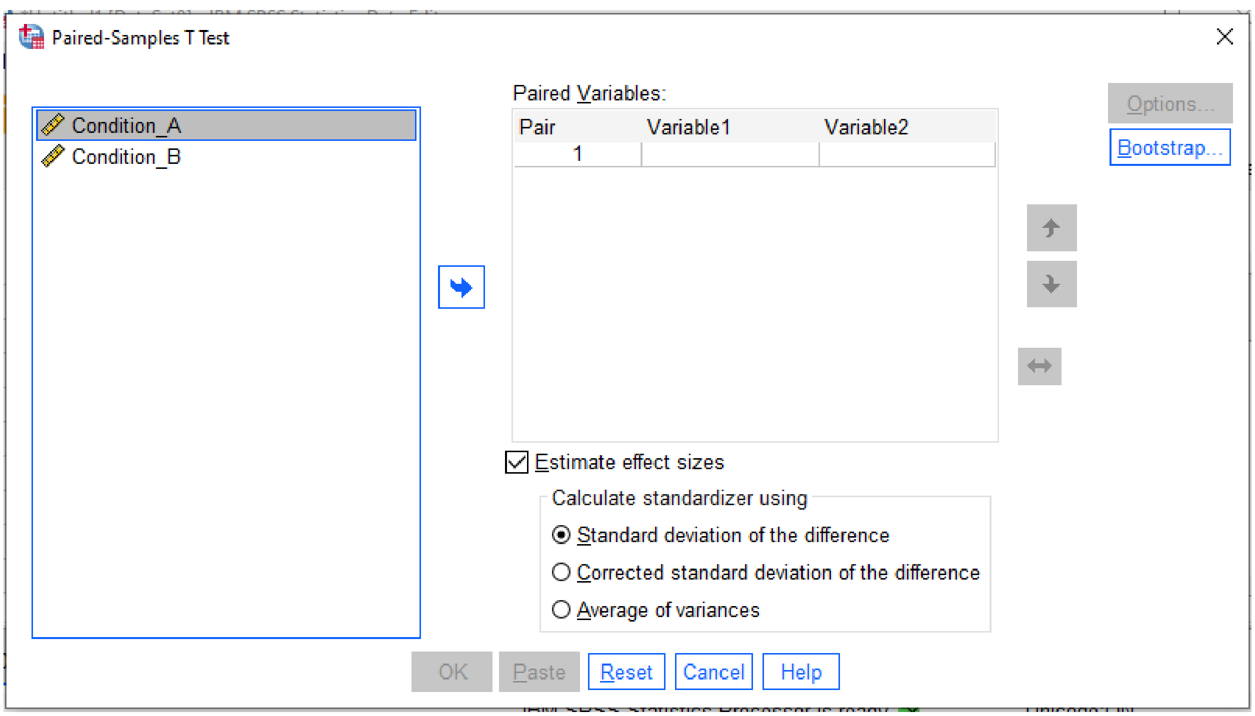
Example: Compare the mean score in Condition A to the mean score in Condition B.

Example data:

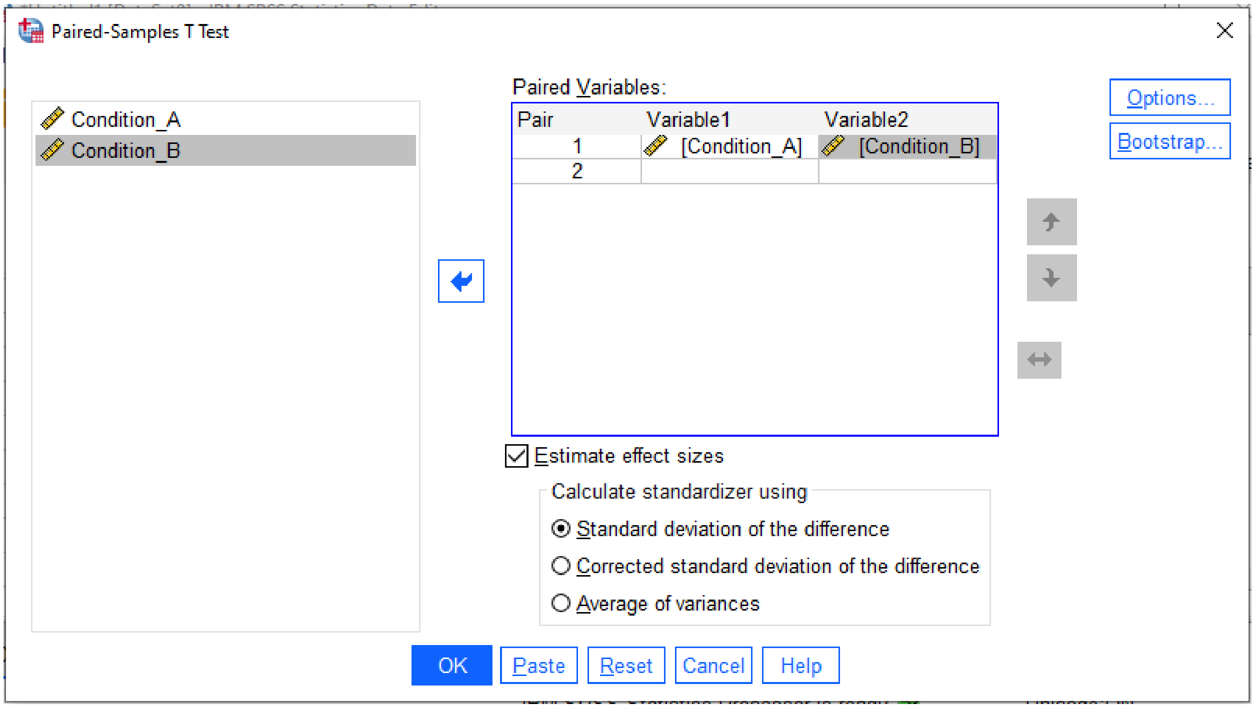
	Condition_A	Condition_B
1	21.00	12.00
2	16.00	4.00
3	15.00	6.00
4	19.00	9.00
5	20.00	10.00
6	11.00	7.00

How to run the test:

1) Click on Analyze > Compare Means > Paired-Samples T Test… to open the dialog box:



2) Move the name of the variable for one condition to the "Variable1" column and move the other variable name to the "Variable2" column. (Check the "Estimate effect sizes" box at the bottom to calculate Cohen's d.):



3) Click "OK". The results will appear in the Output window.

How to read the output:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Condition_A	17.0000	6	3.74166	1.52753
	Condition_B	8.0000	6	2.89828	1.18322

This table shows the descriptive statistics for your variables.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Condition_A & Condition_B	6	.701	.121

This table shows the correlation between your variables (in case you want that information).

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Condition_A - Condition_B	9.00000	2.68328	1.09545	6.18407	11.81593	8.216	5	<.001

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardizer[a]	Point Estimate	Lower	Upper
Pair 1	Condition_A - Condition_B	Cohen's d	2.68328	3.354	1.184	5.507
		Hedges' correction	2.90793	3.095	1.093	5.082

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Cohen's d (effect size) is shown in this cell. In this example, Cohen's d = 3.354.

How to report the results in APA format:

General format: $t(\text{df}) = \#.\#\#,\ p = .\#\#\#$

For this example: $t(5) = 8.216,\ p < .001$

Note that the p-value reported by SPSS is for a two-tailed (non-directional) test. If you are doing a one-tailed (directional) test, you must divide the reported p-value by 2 to get the correct p-value.

One-Way Independent-Groups (Between-Subjects) ANOVA

Purpose: To compare the means of three or more samples that contain independent observations of a variable. If the ANOVA produces significant results, do a post hoc test to determine specifically which sample means are different from each other.

How to set up the data: One column should contain the variable being compared for the groups/samples (the dependent variable, or DV). Another column should contain an identifier that indicates to which group/sample the observation belongs. Each row contains data for a different subject. The grouping variable must be nominal and numeric.

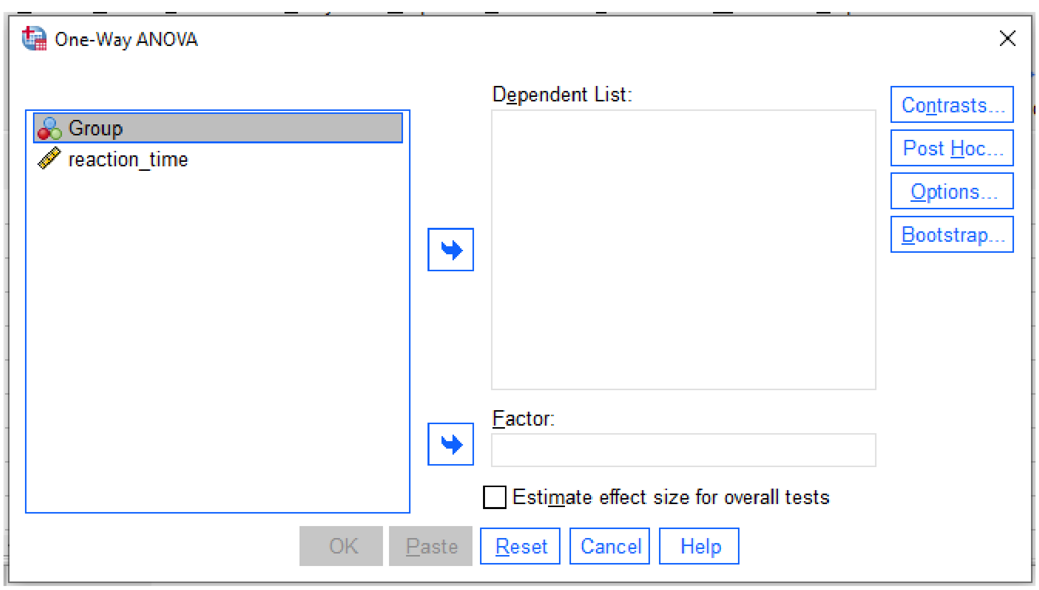
Example: Compare the mean reaction times for Group 1, Group 2, and Group 3.

Example data:

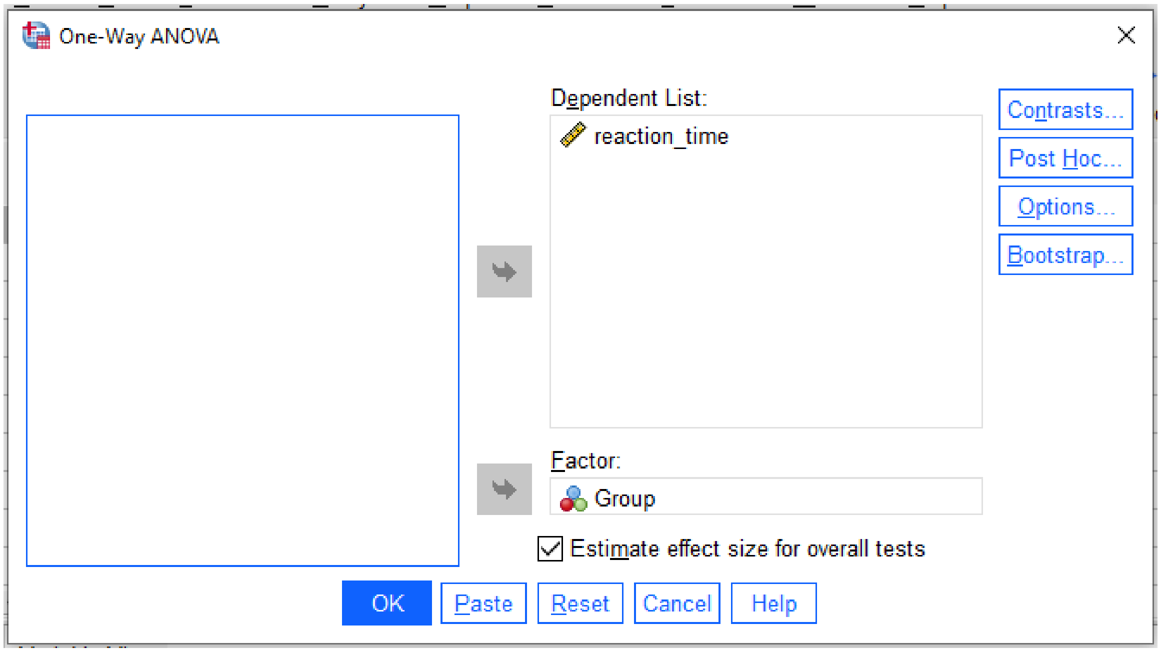
	Group	reaction_time
1	1	40.00
2	2	21.00
3	1	36.00
4	3	23.00
5	3	24.00
6	2	24.00
7	1	37.00
8	3	26.00
9	2	27.00

How to run the test:

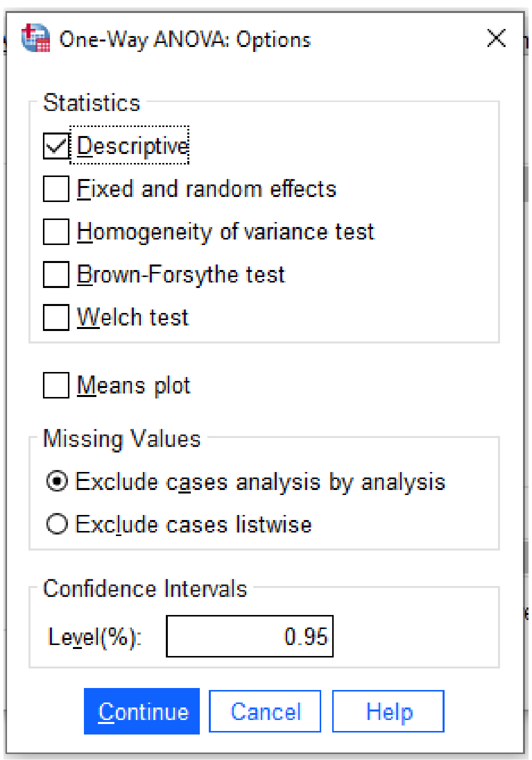
1) Click on Analyze > Compare Means > One-Way ANOVA... to open the dialog box:



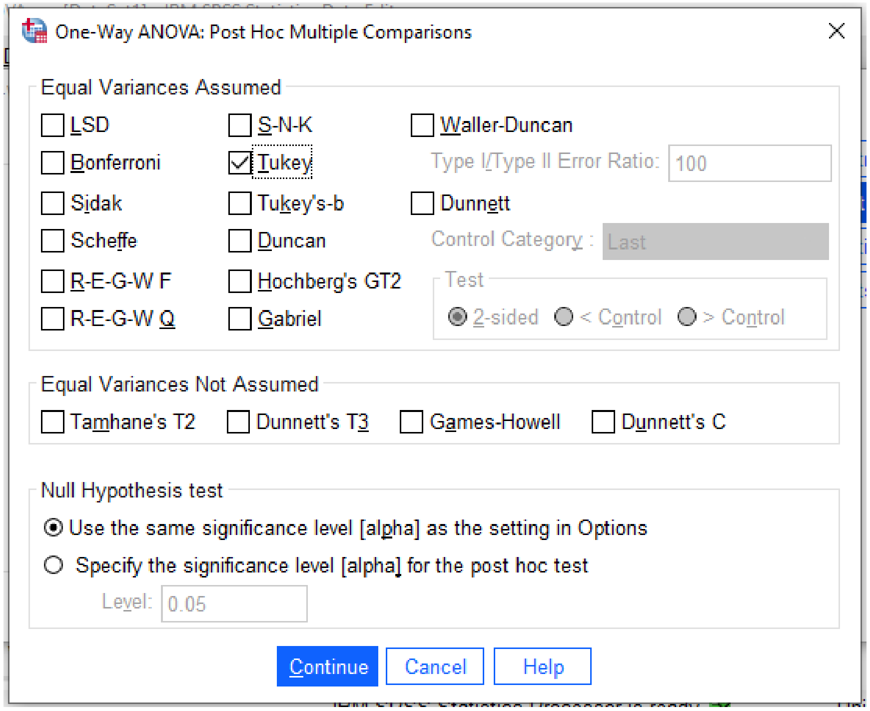
2) Move the DV to "Dependent List" and move the grouping variable to "Factor". Check the box labeled "Estimate effect size for overall tests".:



3) Click "Options…" Check the box labeled "Descriptive", then click Continue:



4) In the "One-Way ANOVA" dialog box, click "Post Hoc…" Check the box labeled "Tukey", then click "Continue":



5) In the "One-Way ANOVA" dialog box, click "OK". The results will appear in the Output window.

How to read the output:

Descriptives

reaction_time

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
1	3	37.6667	2.08167	1.20185	32.4955	42.8378	36.00	40.00
2	3	24.0000	3.00000	1.73205	16.5476	31.4524	21.00	27.00
3	3	24.3333	1.52753	.88192	20.5388	28.1279	23.00	26.00
Total	9	28.6667	7.03562	2.34521	23.2586	34.0747	21.00	40.00

This table shows the descriptive statistics for the DV in the different groups.

ANOVA

reaction_time

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	364.667	2	182.333	34.915	<.001
Within Groups	31.333	6	5.222		
Total	396.000	8			

How to report the results in APA format:

General format: F(df$_{BG}$, df$_{WG}$) = #.##, p = .###

For this example: $F(2, 6) = 34.915, p < .001$

ANOVA Effect Sizes[a]

		Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
reaction_time	Eta-squared	.921	.530	.951
	Epsilon-squared	.895	.374	.935
	Omega-squared Fixed-effect	.883	.347	.928
	Omega-squared Random-effect	.790	.210	.865

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

Eta-squared is an estimate of effect size. In this example, eta-squared equals .921.

Because the results of the ANOVA are significant, you should look at the results of the post hoc test:

Post Hoc Tests

Multiple Comparisons

Dependent Variable: reaction_time

Tukey HSD

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	13.66667*	1.86587	<.001	7.9417	19.3917
	3	13.33333*	1.86587	<.001	7.6083	19.0583
2	1	-13.66667*	1.86587	<.001	-19.3917	-7.9417
	3	-.33333	1.86587	.983	-6.0583	5.3917
3	1	-13.33333*	1.86587	<.001	-19.0583	-7.6083
	2	.33333	1.86587	.983	-5.3917	6.0583

*. The mean difference is significant at the 0.05 level.

The p-values (Sig.) show which pairs of sample means are significantly different.

Groups 1 and 2 are significantly different.

Groups 1 and 3 are significantly different.

Groups 2 and 3 are not significantly different.

There are no statistics to report in APA format for the post hoc test. Simply report which means are significantly different.

One-Way Repeated-Measures (Within-Subjects) ANOVA

Purpose: To compare the means of three or more measures that were performed on a single group of subjects. If the ANOVA produces significant results, do a post hoc test to determine specifically which sample means are different from each other.

How to set up the data: The different measures should be placed in different columns. Each row contains values for a single subject.

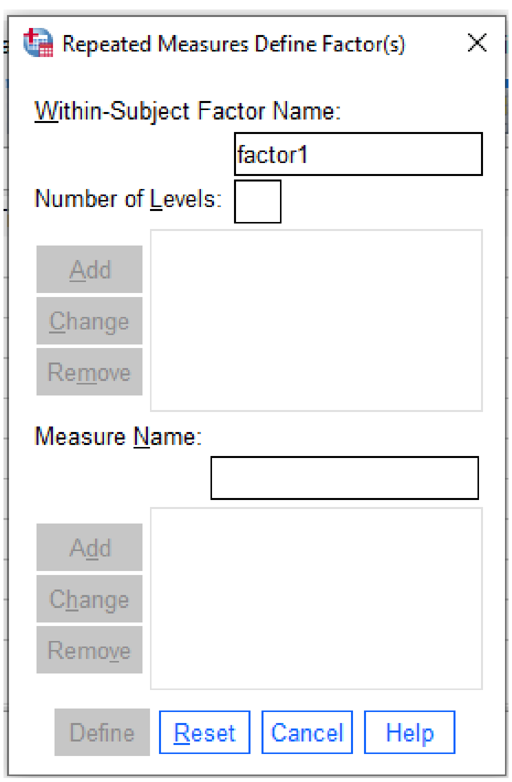
Example: A group of 5 subjects takes a test at three different times. Test whether the scores are significantly different at different times.

Example data:

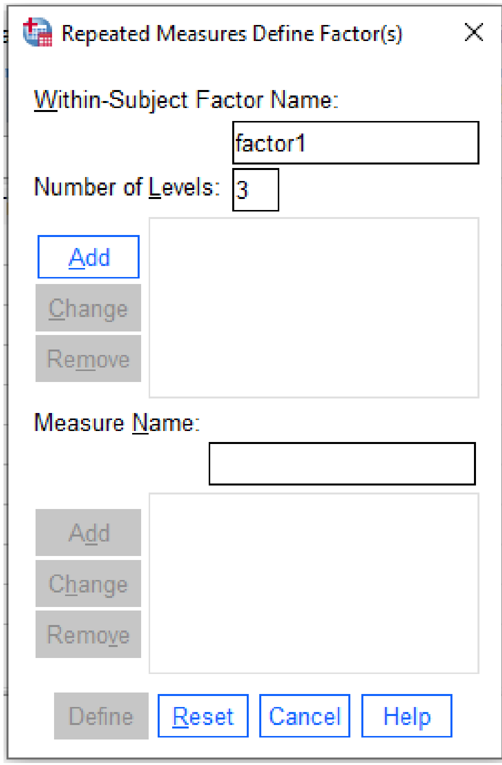
	Time_1	Time_2	Time_3
1	18.00	21.00	25.00
2	19.00	20.00	21.00
3	16.00	19.00	18.00
4	18.00	24.00	22.00
5	20.00	23.00	25.00

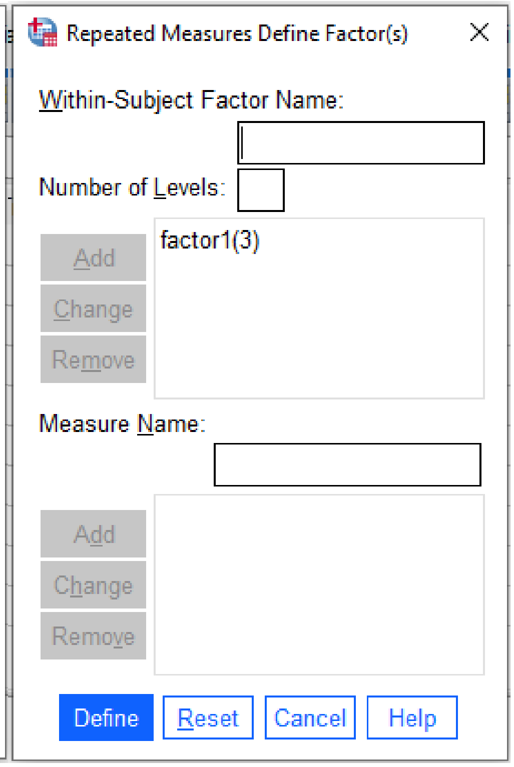
How to run the test:

1) Click on Analyze > General Linear Model > Repeated Measures… to open the dialog box:

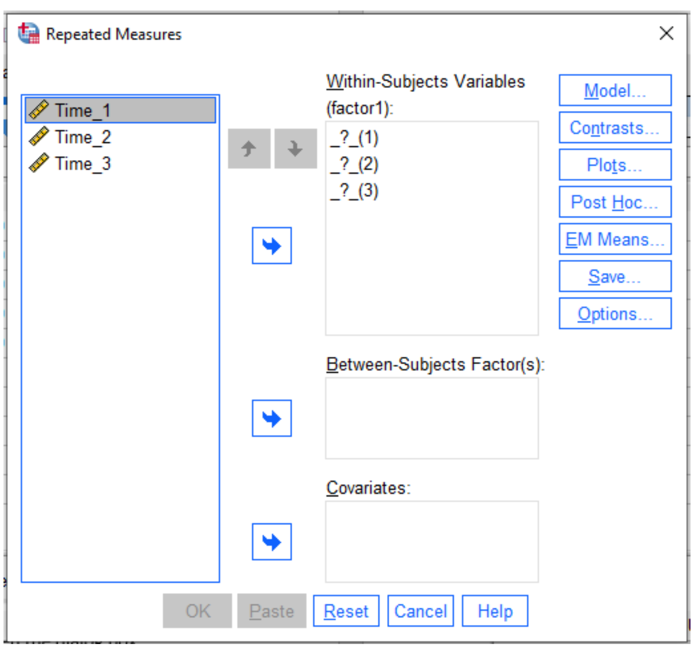


2) Enter the number of levels of the repeated-measures variable in the "Number of Levels" box, then click "Add":

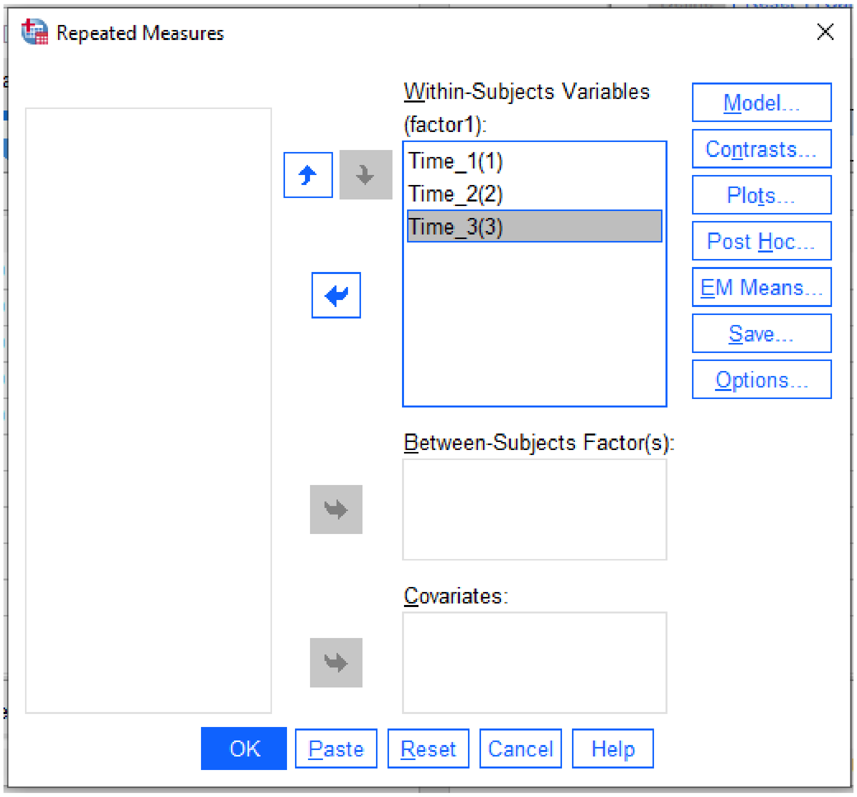




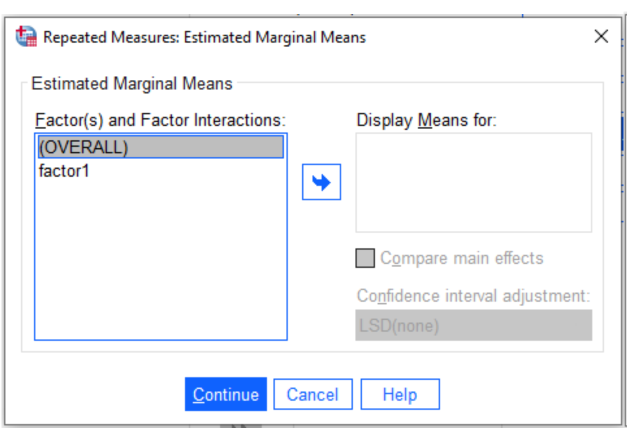
3) Click "Define" to open the "Repeated Measures" dialog box:

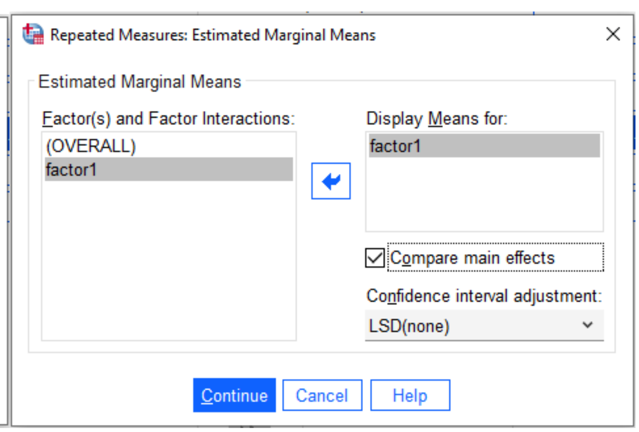


4) Move the three levels of the variable to the "Within-Subjects Variables" box:

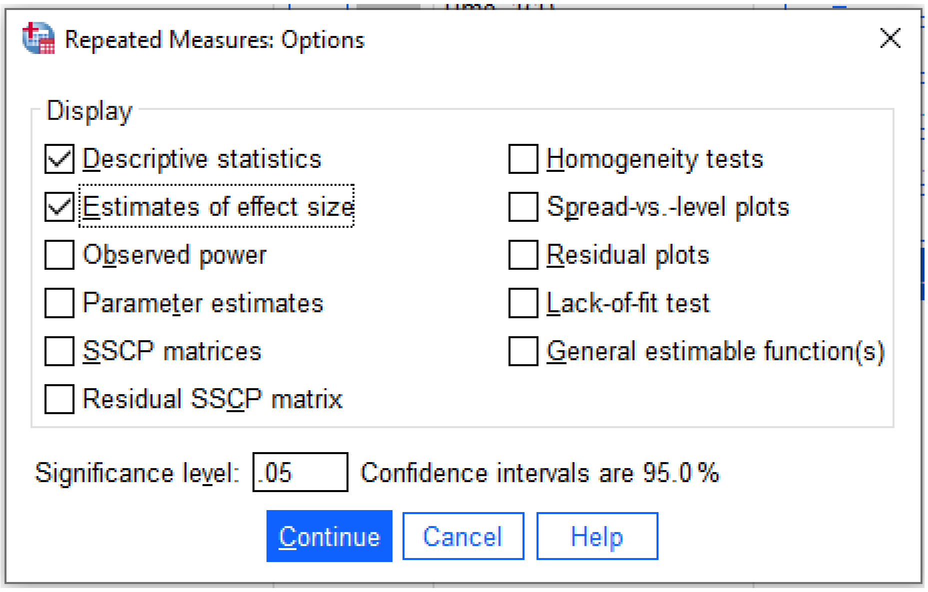


5) Click "EM Means". Move "factor1" to the "Display Means for" box. Check the "Compare main effects" box. From the "Confidence interval adjustment" drop-down menu, select "LSD(none)". Click "Continue".





6) In the "Repeated Measures" dialog box, click "Options…" In the "Repeated Measures: Options" dialog box, check "Descriptive statistics" and "Estimates of effect size". Click "Continue":



7) In the "Repeated Measures" dialog box, click "OK". The results will appear in the Output window.

How to read the output: The output will contain many tables. Only some of the tables contain important information for our purposes. Not all of the tables are shown below.

Descriptive Statistics

	Mean	Std. Deviation	N
Time_1	18.2000	1.48324	5
Time_2	21.4000	2.07364	5
Time_3	22.2000	2.94958	5

This table shows the descriptive statistics for the three levels of the repeated-measures variable.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
factor1	Sphericity Assumed	44.800	2	22.400	10.030	.007	.715
	Greenhouse-Geisser	44.800	1.811	24.740	10.030	.009	.715
	Huynh-Feldt	44.800	2.000	22.400	10.030	.007	.715
	Lower-bound	44.800	1.000	44.800	10.030	.034	.715
Error(factor1)	Sphericity Assumed	17.867	8	2.233			
	Greenhouse-Geisser	17.867	7.243	2.467			
	Huynh-Feldt	17.867	8.000	2.233			
	Lower-bound	17.867	4.000	4.467			

How to report the results in APA format:

General format: $F(df_{BG}, df_{Error}) = \#.\#\#, p = .\#\#\#$

For this example: $F(2, 8) = 10.030, p = .007$

Partial eta-squared is a measure of effect size. In this example, partial eta-squared equals .715.

Because the results of the ANOVA are significant, you should look at the results of the post hoc test:

Pairwise Comparisons

Measure: MEASURE_1

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-3.200*	.800	.016	-5.421	-.979
	3	-4.000*	.949	.014	-6.634	-1.366
2	1	3.200*	.800	.016	.979	5.421
	3	-.800	1.068	.495	-3.764	2.164
3	1	4.000*	.949	.014	1.366	6.634
	2	.800	1.068	.495	-2.164	3.764

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The p-values (Sig.) show which pairs of sample means are significantly different.

Groups 1 and 2 are significantly different.

Groups 1 and 3 are significantly different.

Groups 2 and 3 are not significantly different.

There are no statistics to report in APA format for the post hoc test. Simply report which means are significantly different.

Two-Way Independent-Groups ANOVA

Purpose: To compare the means for a dependent variable when there are two independent variables, and there are different subjects in each condition of the experiment. This allows you to evaluate the significance of the two main effects and the interaction.

How to set up the data: Each row contains data for a single subject. One column shows the level of IV1 that the subject experienced and another column shows the level of IV2 for that subject. The remaining column shows the value of the DV for that subject.

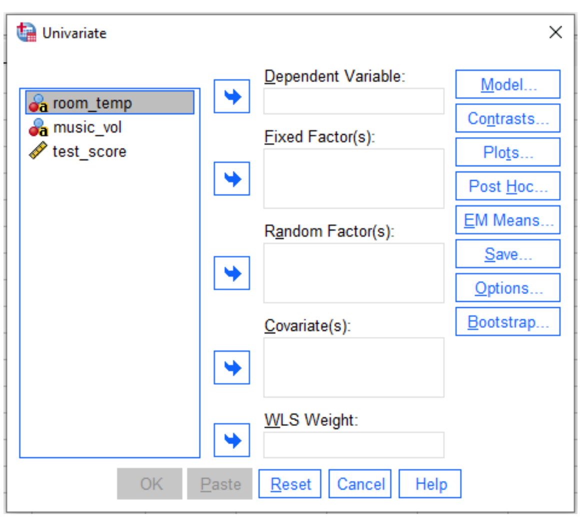
Example: All subjects take a math test. The score on the math test is the DV. Each subject takes the test in either a cold room or a warm room, and either with quiet music or loud music playing. IV1: cold room or warm room. IV2: quiet music or loud music. There are four groups in this 2x2 design, and there are three subjects in each group.

Example data:

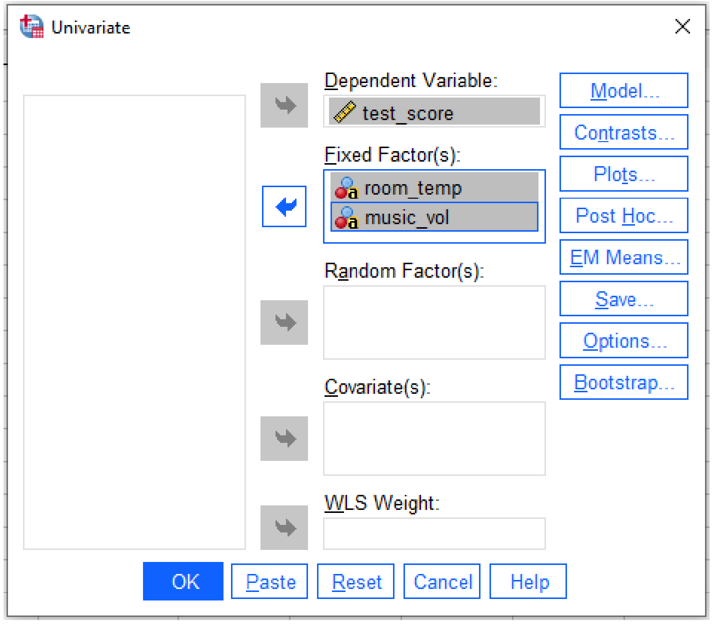
	room_temp	music_vol	test_score
1	cold	quiet	10.00
2	cold	quiet	12.00
3	cold	quiet	11.00
4	cold	loud	12.00
5	cold	loud	14.00
6	cold	loud	11.00
7	warm	quiet	17.00
8	warm	quiet	18.00
9	warm	quiet	20.00
10	warm	loud	9.00
11	warm	loud	11.00
12	warm	loud	12.00

How to run the test:

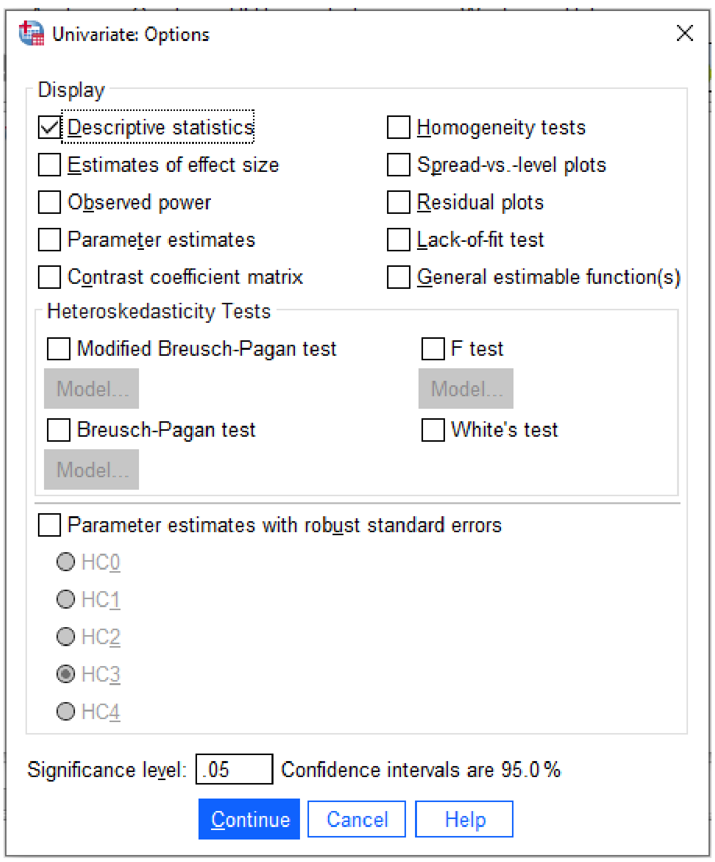
1) Click on Analyze > General Linear Model > Univariate… to open the dialog box:



2) Move the DV to "Dependent Variable" and move the IVs to "Fixed Factor(s)":



3) Click "Options…" Check the box labeled "Descriptive statistics", then click Continue:



4) In the "Univariate" dialog box, click "OK". The results will appear in the Output window.

How to read the output:

Descriptive Statistics

Dependent Variable: test_score

room_temp	music_vol	Mean	Std. Deviation	N
cold	loud	12.3333	1.52753	3
	quiet	11.0000	1.00000	3
	Total	11.6667	1.36626	6
warm	loud	10.6667	1.52753	3
	quiet	18.3333	1.52753	3
	Total	14.5000	4.41588	6
Total	loud	11.5000	1.64317	6
	quiet	14.6667	4.17931	6
	Total	13.0833	3.44986	12

This table shows the descriptive statistics for the DV in the different groups, defined by different combinations of the levels of the IVs.

Tests of Between-Subjects Effects

Dependent Variable: test_score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	114.917[a]	3	38.306	19.153	<.001
Intercept	2054.083	1	2054.083	1027.042	<.001
room_temp	24.083	1	24.083	12.042	.008
music_vol	30.083	1	30.083	15.042	.005
room_temp * music_vol	60.750	1	60.750	30.375	<.001
Error	16.000	8	2.000		
Total	2185.000	12			
Corrected Total	130.917	11			

a. R Squared = .878 (Adjusted R Squared = .832)

Results for the two main effects and the interaction are in these rows. (Note the “Source” in the first column.)

How to report the results in APA format:

General format: $F(df_{BG}, df_{WG})$ = #.##, p = .###

For this example:

For the main effect of room temp: $F(1, 8) = 12.042$, $p = .008$

For the main effect of music vol: $F(1, 8) = 15.042$, $p = .005$

For the interaction: $F(1, 8) = 30.375$, $p < .001$

Two-Way Repeated-Measures ANOVA

Purpose: To compare the means for a dependent variable when there are two independent variables, and all subjects experience all levels of both IVs (i.e., the same subjects are in all groups). This allows you to evaluate the significance of the two main effects and the interaction.

How to set up the data: Each row contains data for a single subject. Each column contains the value of the DV for one of the combinations of levels of the IVs.

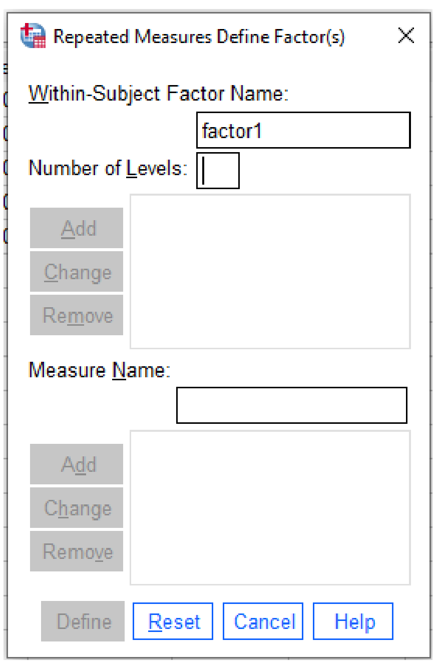
Example: All subjects take a test of attention. The score on the attention test is the DV. Each subject takes the test four times, once in each of the following conditions: (1) in a cold room with quiet music, (2) in a cold room with loud music, (3) in a warm room with quiet music, and (4) in a warm room with loud music. IV1: cold room or warm room. IV2: quiet music or loud music. There are five subjects and four groups (conditions) in this 2x2 design. Each subject provides a score in each of the four conditions.

Example data:

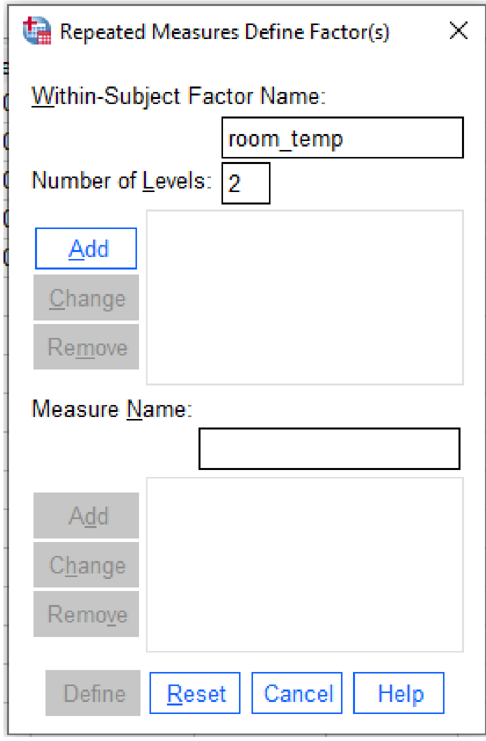
	cold_quiet	cold_loud	warm_quiet	warm_loud
1	20.00	12.00	24.00	19.00
2	18.00	14.00	26.00	16.00
3	22.00	11.00	22.00	14.00
4	21.00	16.00	19.00	17.00
5	16.00	12.00	21.00	16.00

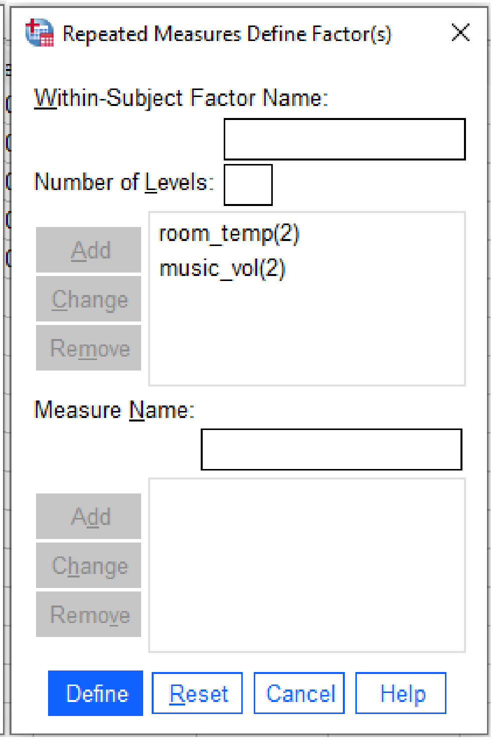
How to run the test:

1) Click on Analyze > General Linear Model > Repeated Measures… to open the dialog box:

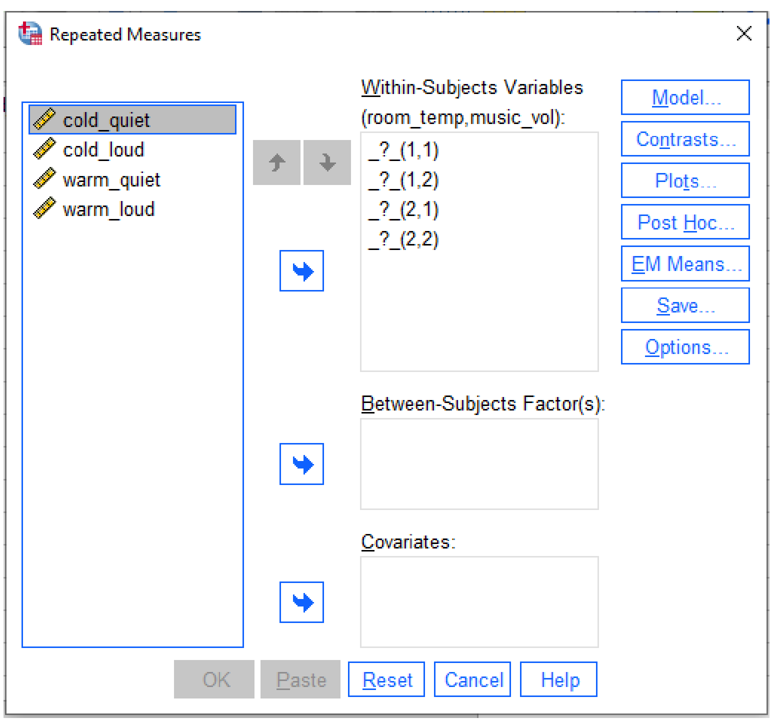


2) For each IV, enter the name of the variable in the "Within-Subject Factor Name" box and the number of levels in the "Number of Levels" box, then click on "Add". After you have added both IVs (as in the box on the right below), click "Define":

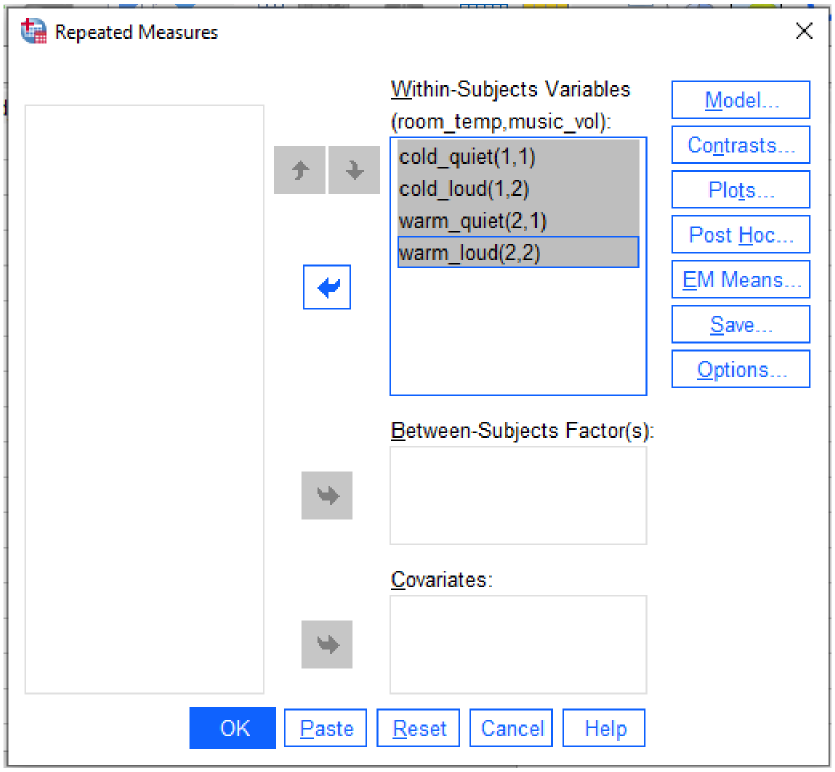




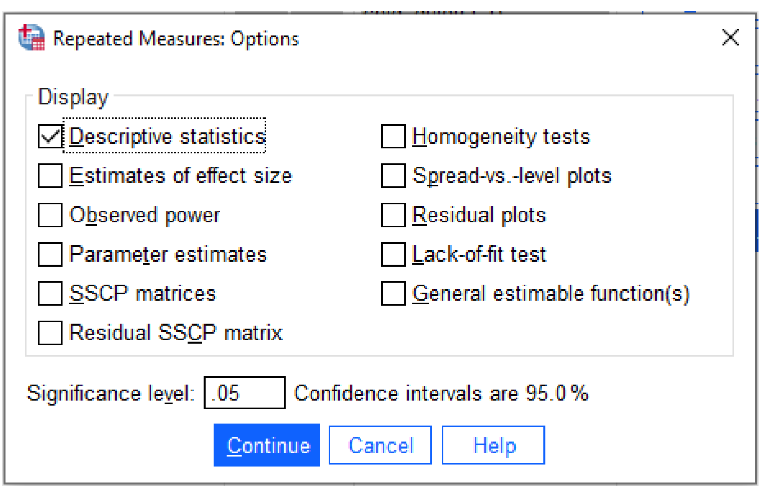
3) The "Repeated Measures" dialog box appears:



4) Move the four conditions from the left to "Within-Subjects Variables". Be sure to keep track of the levels of the two variables and move them correctly. In this example cold = 1, warm = 2, quiet = 1, loud = 2. Move the cold_quiet variable to the Within-Subjects Variable identified as (1,1).



5) Click "Options...", check the box labeled "Descriptive statistics", and click "Continue":



6) In the "Repeated Measures" dialog box, click "OK". The results will appear in the Output window.

How to read the output: The output will contain many tables. Only some of the tables contain important information for our purposes. Not all of the tables are shown below.

Descriptive Statistics

	Mean	Std. Deviation	N
cold_quiet	19.4000	2.40832	5
cold_loud	13.0000	2.00000	5
warm_quiet	22.4000	2.70185	5
warm_loud	16.4000	1.81659	5

This table shows the descriptive statistics for the DV in the different conditions, defined by different combinations of the levels of the IVs.

(continued on next page)

How to report the first main effect:

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
room_temp	Sphericity Assumed	51.200	1	51.200	7.642	.051
	Greenhouse-Geisser	51.200	1.000	51.200	7.642	.051
	Huynh-Feldt	51.200	1.000	51.200	7.642	.051
	Lower-bound	51.200	1.000	51.200	7.642	.051
Error(room_temp)	Sphericity Assumed	26.800	4	6.700		
	Greenhouse-Geisser	26.800	4.000	6.700		
	Huynh-Feldt	26.800	4.000	6.700		
	Lower-bound	26.800	4.000	6.700		
music_vol	Sphericity Assumed	192.200	1	192.200	35.266	.004
	Greenhouse-Geisser	192.200	1.000	192.200	35.266	.004
	Huynh-Feldt	192.200	1.000	192.200	35.266	.004
	Lower-bound	192.200	1.000	192.200	35.266	.004
Error(music_vol)	Sphericity Assumed	21.800	4	5.450		
	Greenhouse-Geisser	21.800	4.000	5.450		
	Huynh-Feldt	21.800	4.000	5.450		
	Lower-bound	21.800	4.000	5.450		
room_temp * music_vol	Sphericity Assumed	.200	1	.200	.051	.833
	Greenhouse-Geisser	.200	1.000	.200	.051	.833
	Huynh-Feldt	.200	1.000	.200	.051	.833
	Lower-bound	.200	1.000	.200	.051	.833
Error (room_temp*music_vol)	Sphericity Assumed	15.800	4	3.950		
	Greenhouse-Geisser	15.800	4.000	3.950		
	Huynh-Feldt	15.800	4.000	3.950		
	Lower-bound	15.800	4.000	3.950		

How to report the results in APA format:

General format: $F(\text{df}_{BG}, \text{df}_{Error}) = \#.\#\#, p = .\#\#\#$

For this example:

For the main effect of **ROOM TEMP**: $F(1, 4) = 7.642, p = .051$

(continued on next page)

How to report the second main effect:

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
room_temp	Sphericity Assumed	51.200	1	51.200	7.642	.051
	Greenhouse-Geisser	51.200	1.000	51.200	7.642	.051
	Huynh-Feldt	51.200	1.000	51.200	7.642	.051
	Lower-bound	51.200	1.000	51.200	7.642	.051
Error(room_temp)	Sphericity Assumed	26.800	4	6.700		
	Greenhouse-Geisser	26.800	4.000	6.700		
	Huynh-Feldt	26.800	4.000	6.700		
	Lower-bound	26.800	4.000	6.700		
music_vol	Sphericity Assumed	192.200	1	192.200	35.266	.004
	Greenhouse-Geisser	192.200	1.000	192.200	35.266	.004
	Huynh-Feldt	192.200	1.000	192.200	35.266	.004
	Lower-bound	192.200	1.000	192.200	35.266	.004
Error(music_vol)	Sphericity Assumed	21.800	4	5.450		
	Greenhouse-Geisser	21.800	4.000	5.450		
	Huynh-Feldt	21.800	4.000	5.450		
	Lower-bound	21.800	4.000	5.450		
room_temp * music_vol	Sphericity Assumed	.200	1	.200	.051	.833
	Greenhouse-Geisser	.200	1.000	.200	.051	.833
	Huynh-Feldt	.200	1.000	.200	.051	.833
	Lower-bound	.200	1.000	.200	.051	.833
Error (room_temp*music_vol)	Sphericity Assumed	15.800	4	3.950		
	Greenhouse-Geisser	15.800	4.000	3.950		
	Huynh-Feldt	15.800	4.000	3.950		
	Lower-bound	15.800	4.000	3.950		

How to report the results in APA format:

General format: $F(df_{BG}, df_{Error})$ = #.##, p = .###

For this example:

For the main effect of **MUSIC VOL**: $F(1, 4) = 35.266, p = .004$

(continued on next page)

How to report the interaction:

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
room_temp	Sphericity Assumed	51.200	1	51.200	7.642	.051
	Greenhouse-Geisser	51.200	1.000	51.200	7.642	.051
	Huynh-Feldt	51.200	1.000	51.200	7.642	.051
	Lower-bound	51.200	1.000	51.200	7.642	.051
Error(room_temp)	Sphericity Assumed	26.800	4	6.700		
	Greenhouse-Geisser	26.800	4.000	6.700		
	Huynh-Feldt	26.800	4.000	6.700		
	Lower-bound	26.800	4.000	6.700		
music_vol	Sphericity Assumed	192.200	1	192.200	35.266	.004
	Greenhouse-Geisser	192.200	1.000	192.200	35.266	.004
	Huynh-Feldt	192.200	1.000	192.200	35.266	.004
	Lower-bound	192.200	1.000	192.200	35.266	.004
Error(music_vol)	Sphericity Assumed	21.800	4	5.450		
	Greenhouse-Geisser	21.800	4.000	5.450		
	Huynh-Feldt	21.800	4.000	5.450		
	Lower-bound	21.800	4.000	5.450		
room_temp * music_vol	Sphericity Assumed	.200	1	.200	.051	.833
	Greenhouse-Geisser	.200	1.000	.200	.051	.833
	Huynh-Feldt	.200	1.000	.200	.051	.833
	Lower-bound	.200	1.000	.200	.051	.833
Error (room_temp*music_vol)	Sphericity Assumed	15.800	4	3.950		
	Greenhouse-Geisser	15.800	4.000	3.950		
	Huynh-Feldt	15.800	4.000	3.950		
	Lower-bound	15.800	4.000	3.950		

How to report the results in APA format:

General format: $F(df_{BG}, df_{Error}) = \#.\#\#$, $p = .\#\#\#$

For this example:

For the **INTERACTION**: $F(1, 4) = 0.200$, $p = .833$

Two-Way Mixed ANOVA

Purpose: To compare the means for a dependent variable when there are two independent variables. One of the IVs is manipulated between subjects (as an independent-groups variable) and the other IV is manipulated within subjects (as a repeated-measures variable). This allows you to evaluate the significance of the two main effects and the interaction.

How to set up the data: Each row contains data for a single subject. One column contains an identifier indicating which level of the independent-groups IV the subject experienced. Two other columns show the value of the DV for the two levels of the repeated-measures IV.

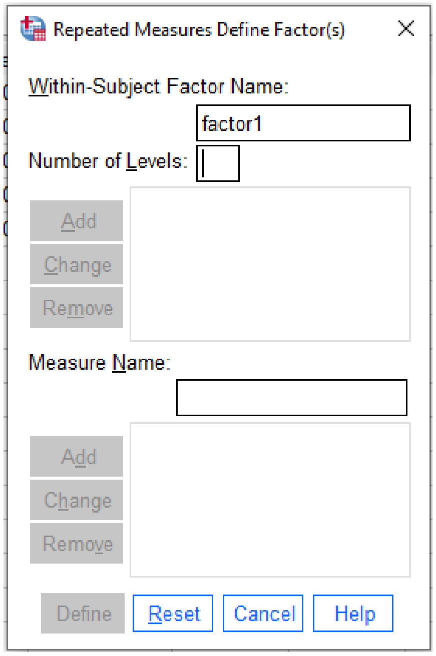
Example: All subjects perform a dexterity task. The score on the dexterity task is the DV. Half of the subjects watch an instructional video before performing the task. The other half of the subjects do not watch an instructional video. Therefore, "video vs. no video" is an IV manipulated between subjects (as an independent-groups variable). Each subject performs the dexterity task twice, once in a room with quiet music playing, and a second time in a room with loud music playing. Therefore, "music volume" is an IV manipulated within subjects (as a repeated-measures variable). There are four conditions in this 2x2 design: (1) video, quiet music, (2) video, loud music, (3) no video, quiet music, and (4) no video, loud music. Each subject provides a score in two of the four conditions. The numbers in the table are the scores on the dexterity task (the DV).

Example data:

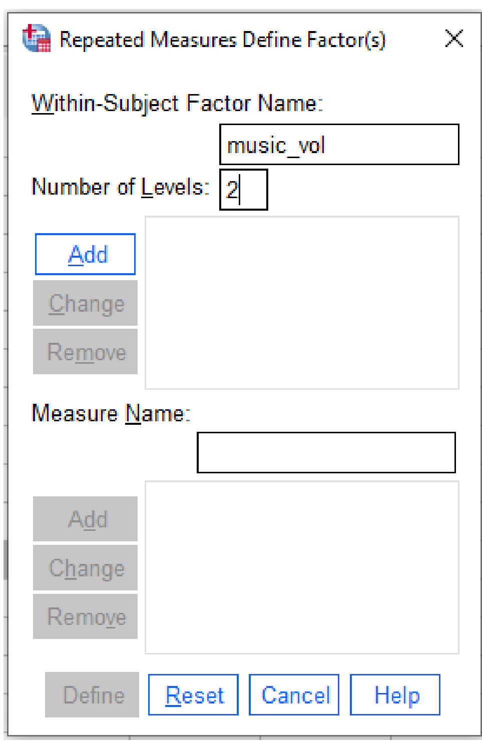
	video_novideo	quiet_music	loud_music
1	video	17.00	15.00
2	video	14.00	12.00
3	video	19.00	13.00
4	video	22.00	12.00
5	no video	10.00	7.00
6	no video	8.00	4.00
7	no video	9.00	6.00
8	no video	10.00	5.00

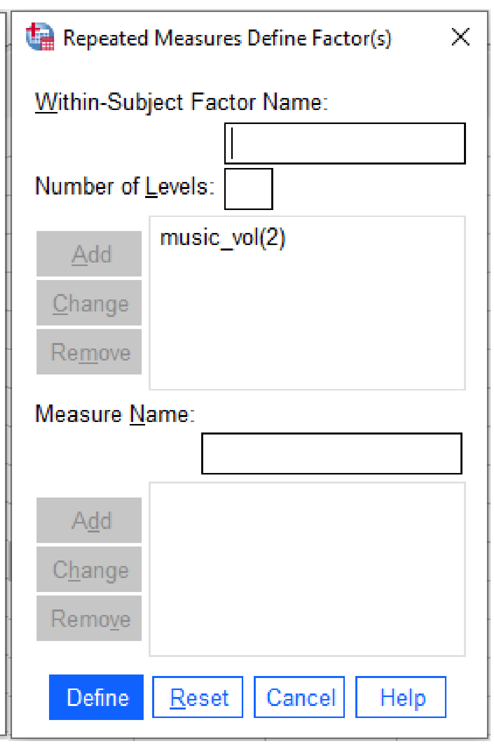
How to run the test:

1) Click on Analyze > General Linear Model > Repeated Measures… to open the dialog box:

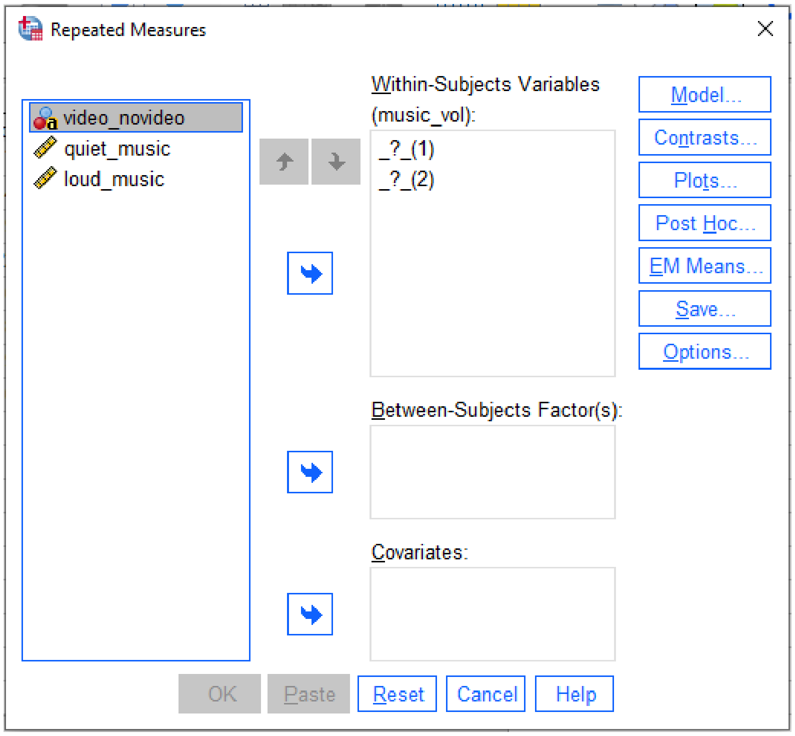


2) For the repeated-measures IV (music volume), enter the name of the variable in the "Within-Subject Factor Name" box and the number of levels in the "Number of Levels" box, then click on "Add" (to get to the right-hand box below). Click "Define":

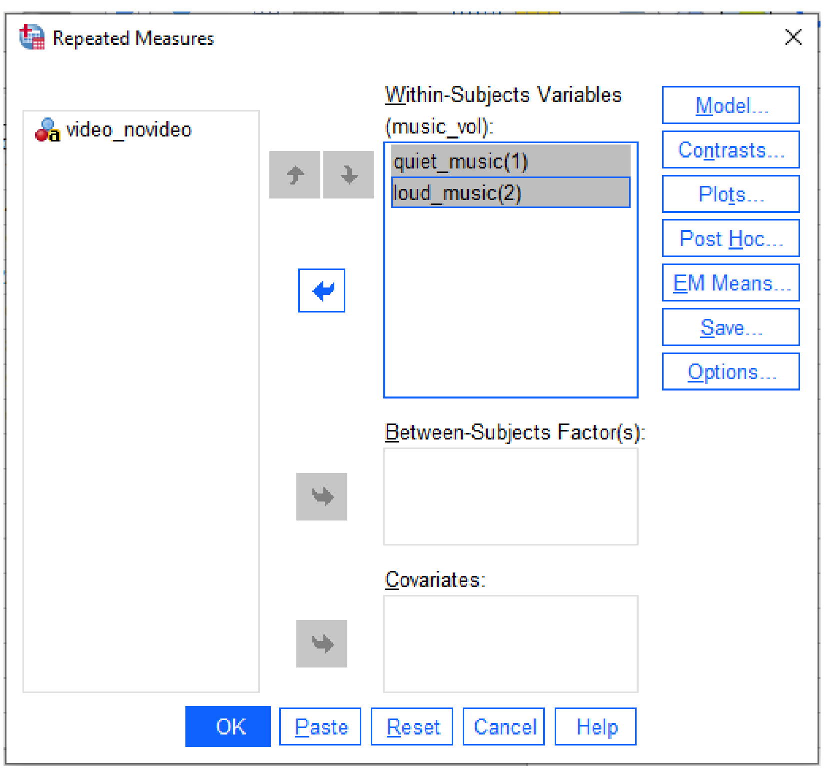




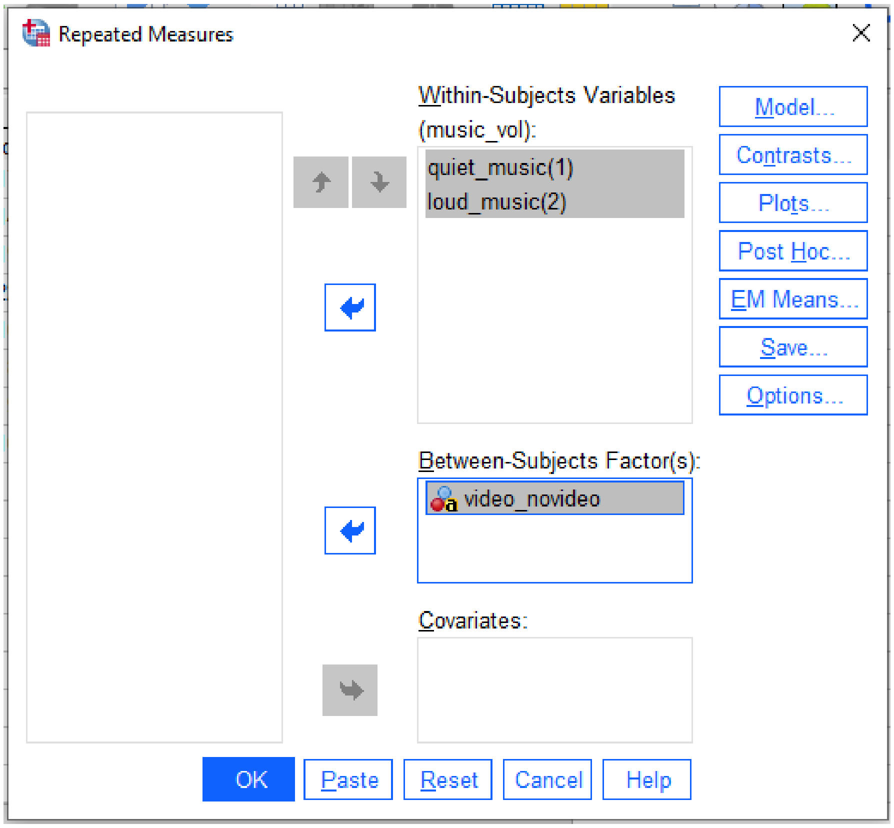
3) The "Repeated Measures" dialog box appears:



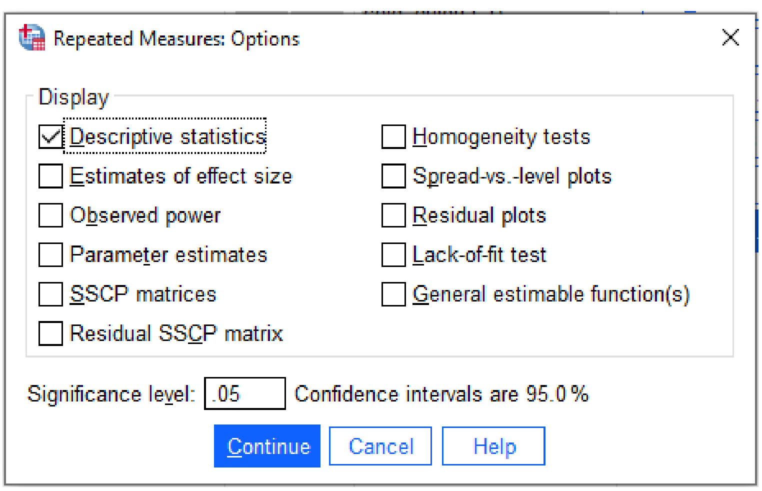
4) Move the two levels of the repeated-measures variable from the left to "Within-Subjects Variables":



5) Move the independent-groups variable to “Between-Subjects Factor(s)”:



6) Click “Options…”, check the box labeled “Descriptive statistics”, and click “Continue”:



7) In the “Repeated Measures” dialog box, click “OK”. The results will appear in the Output window.

How to read the output: The output will contain many tables. Only some of the tables contain important information for our purposes. Not all of the tables are shown below.

Descriptive Statistics

	video_novideo	Mean	Std. Deviation	N
quiet_music	no video	9.2500	.95743	4
	video	18.0000	3.36650	4
	Total	13.6250	5.20817	8
loud_music	no video	5.5000	1.29099	4
	video	13.0000	1.41421	4
	Total	9.2500	4.20034	8

This table shows the descriptive statistics for the DV in the different conditions, defined by different combinations of the levels of the IVs.

(continued on next page)

The following table shows the results for the repeated-measures variable (music_vol) and for the interaction:

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
music_vol	Sphericity Assumed	76.563	1	76.563	19.652	.004
	Greenhouse-Geisser	76.563	1.000	76.563	19.652	.004
	Huynh-Feldt	76.563	1.000	76.563	19.652	.004
	Lower-bound	76.563	1.000	76.563	19.652	.004
music_vol * video_novideo	Sphericity Assumed	1.563	1	1.563	.401	.550
	Greenhouse-Geisser	1.563	1.000	1.563	.401	.550
	Huynh-Feldt	1.563	1.000	1.563	.401	.550
	Lower-bound	1.563	1.000	1.563	.401	.550
Error(music_vol)	Sphericity Assumed	23.375	6	3.896		
	Greenhouse-Geisser	23.375	6.000	3.896		
	Huynh-Feldt	23.375	6.000	3.896		
	Lower-bound	23.375	6.000	3.896		

How to report the results in APA format:

General format: $F(df_{BG}, df_{Error}) = \#.\#\#,\ p = .\#\#\#$

For this example:

For the main effect of **MUSIC VOL**: $F(1, 6) = 19.652, p = .004$

For the **INTERACTION**: $F(1, 6) = 0.401, p = .550$

(continued on next page)

The following table shows the results for the independent-groups variable (video/no video):

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2093.062	1	2093.062	515.215	<.001
video_novideo	264.062	1	264.062	65.000	<.001
Error	24.375	6	4.062		

How to report the results in APA format:

General format: $F(df_{BG}, df_{Error}) = \#.\#\#, p = .\#\#\#$

For this example:

For the main effect of **VIDEO_NOVIDEO**: $F(1, 6) = 65.000, p < .001$

Chi-Square (Chi-Square Test of Independence)

Purpose: To assess the significance of the relationship between two nominal (categorical) variables.

You can perform the chi-square test when your data are set up in either of these two ways:

(1) When your data table shows the value of each nominal variable for each subject.
(2) When your data shows the total number of observations for each combination of values of the nominal variables.

Both are shown below.

DATA FORMAT OPTION 1

How to set up the data: (1) When your data table shows the value of each nominal variable for each subject.

Organize the data in two columns, one for each nominal variable. Each row represents data for a different subject.

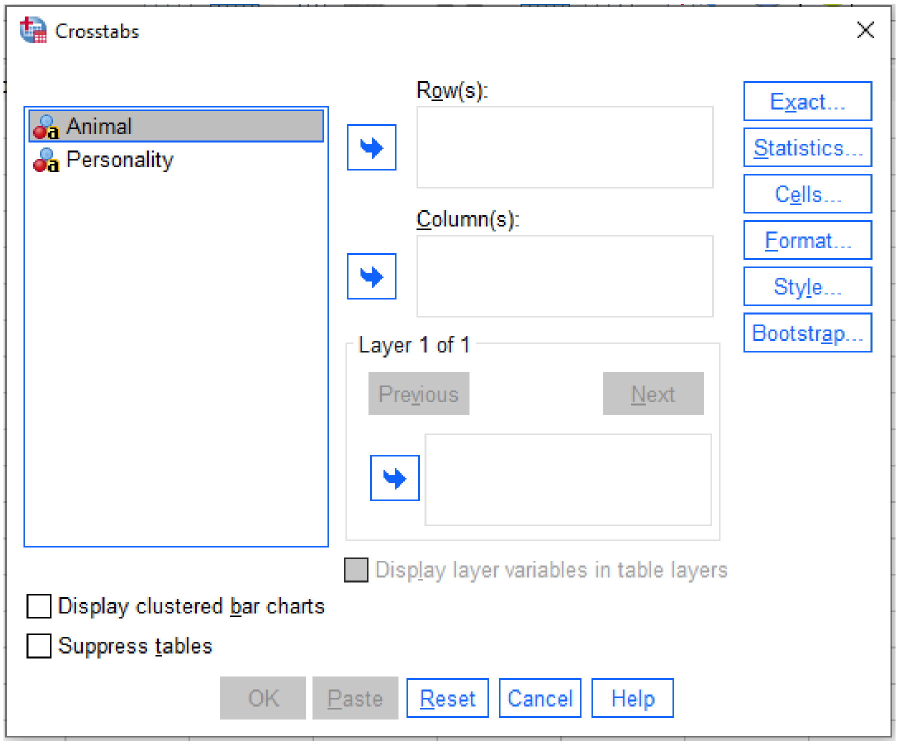
Example: Each subject reports whether they believe they are a dog person or a cat person and whether they think they are introverted or extraverted.

Example data 1: (There is a total of 20 subjects. Only some of the data are shown below.)

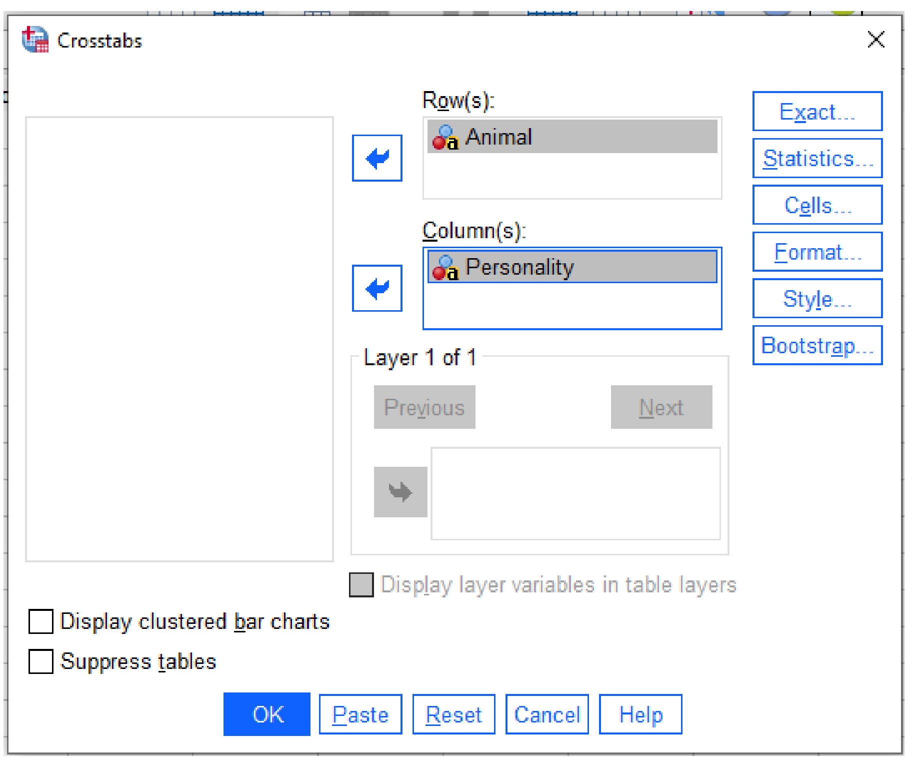
	Animal	Personality
1	cat	introvert
2	cat	extravert
3	cat	extravert
4	dog	introvert
5	cat	introvert
6	dog	extravert
7	dog	extravert
8	dog	extravert
9	cat	introvert

How to run the test:

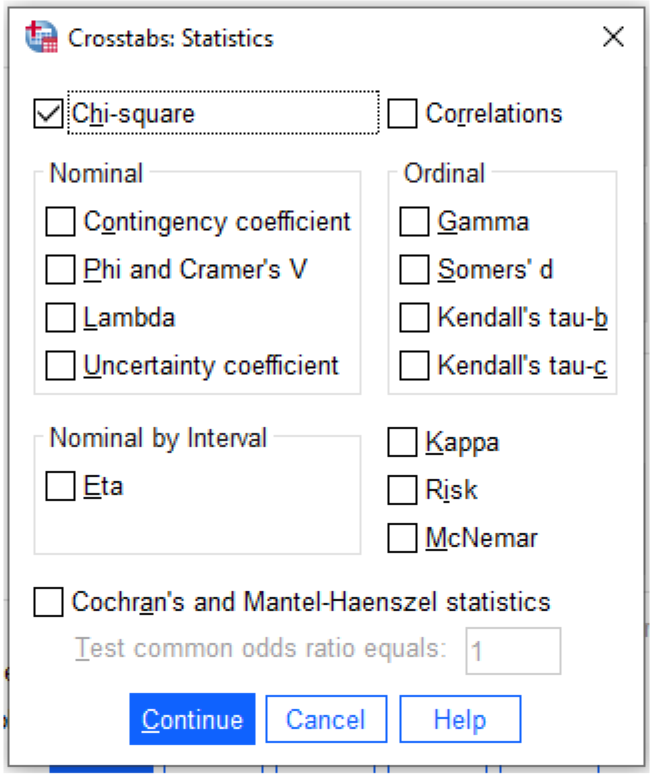
1) Click on Analyze > Descriptive Statistics > Crosstabs… The “Crosstabs” dialog box appears:



2) Move one variable to the “Row(s)” box and one variable to the “Column(s)” box:



3) Click "Statistics…" Check the box labeled "Chi-square," then click Continue:



4) In the Crosstabs dialog box, click "OK." The results will appear in the Output window.

How to read the output:

Animal * Personality Crosstabulation

Count

		Personality		
		extravert	introvert	Total
Animal	cat	4	5	9
	dog	8	3	11
Total		12	8	20

This table shows the total number of subjects for each combination of values of the nominal variables. You will look at different numbers in the output table below depending on whether any cell total is less than 5.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. sided)
Pearson Chi-Square	1.650[a]	1	.199		
Continuity Correction[b]	.682	1	.409		
Likelihood Ratio	1.664	1	.197		
Fisher's Exact Test				.362	.
N of Valid Cases	20				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.60.

b. Computed only for a 2x2 table

Use this row if all cell totals above are 5 or greater.

Use this row if any cell total above is less than 5.

How to report the results in APA format:

General format: X^2(df) = #.##, p = .###

For this example: $X^2(1) = 0.682, p = .409$

Note: As indicated above, if the total in every cell of the contingency table is 5 or greater, use the results in the "Pearson Chi-Square" row of the output. If the total in any cell is less than 5 (as in this example), use the results in the "Continuity Correction" row of the output.

(The second way to run the chi-square test is shown on the next page.)

DATA FORMAT OPTION 2

How to set up the data: (2) When your data show the total number of observations for each combination of values of the nominal variables.

Each variable is represented by a column, and a third column shows a total count or frequency. Each row represents a different combination of the levels of both variables. For example, if there are 2 levels in each variable, there will be 2x2 = 4 rows; if there are 2 levels in one variable and 3 in the other, there will be 2x3 = 6 rows; if there are 3 levels in both variables, there will be 3x3 = 9 rows, and so on…

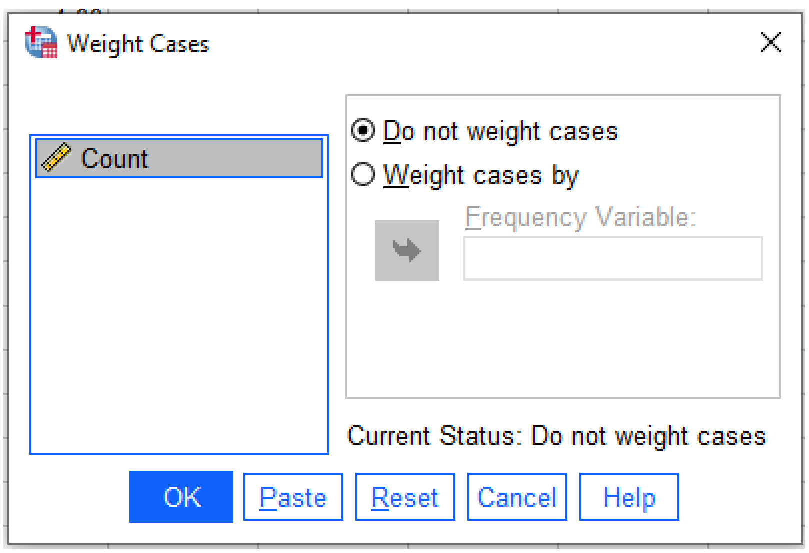
Example: Each subject reports whether they believe they are a dog person or a cat person and whether they think they are introverted or extraverted.

Example data 2:

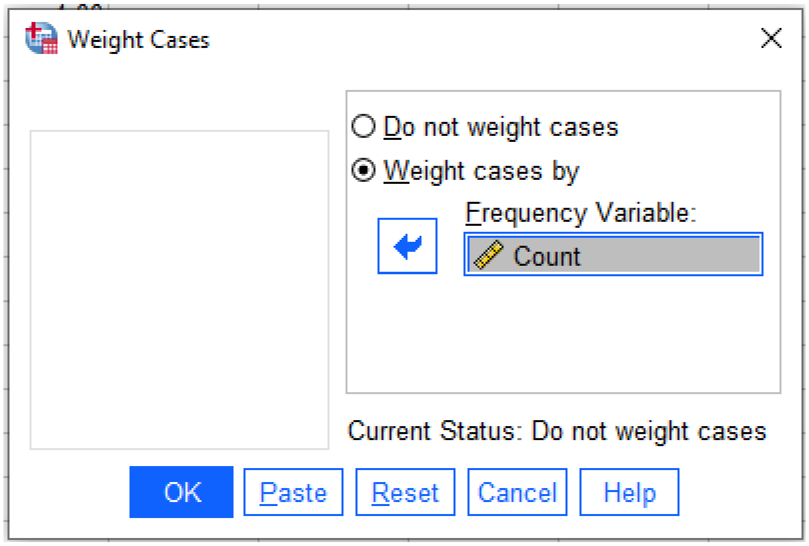
	Animal	Personality	Count
1	cat	introvert	5.00
2	cat	extravert	4.00
3	dog	introvert	3.00
4	dog	extravert	8.00

How to run the test:

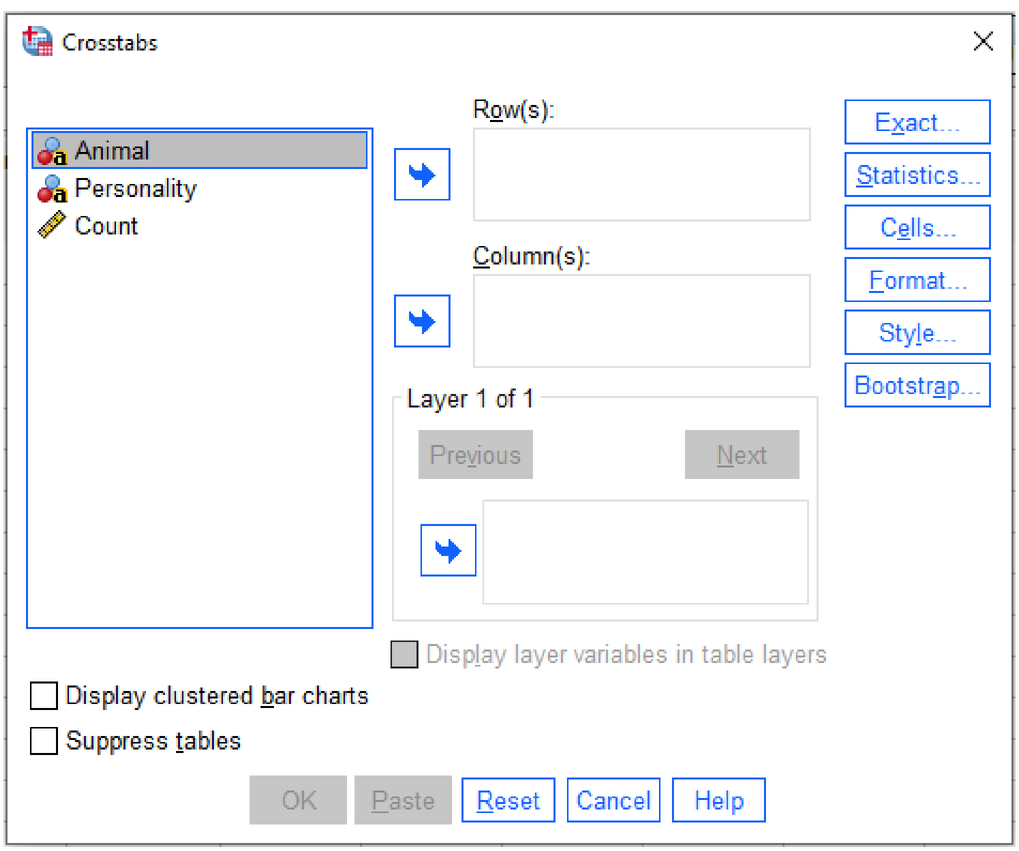
1) Click on "Data" > "Weight Cases…" The Weight Cases dialog box appears:



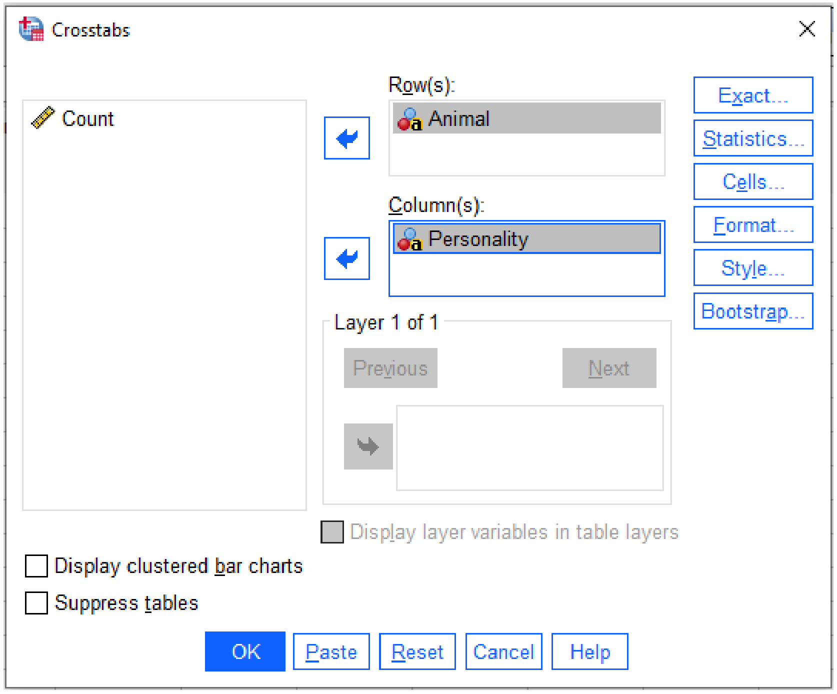
2) Check “Weight cases by” and move “Count” from the left to “Frequency Variable”, then click “OK”:



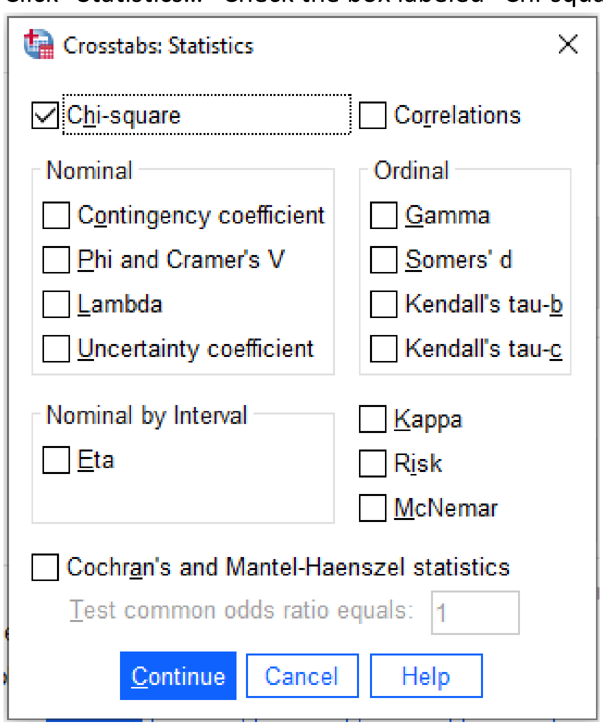
3) Back in the Data Editor window, click on Analyze > Descriptive Statistics > Crosstabs… The “Crosstabs” dialog box appears:



4) Move one variable to the “Row(s)” box and one variable to the “Column(s)” box:



5) Click “Statistics...” Check the box labeled “Chi-square,” then click Continue:



6) In the Crosstabs dialog box, click “OK.” The results will appear in the Output window.

How to read the output:

Animal * Personality Crosstabulation

Count

		Personality		Total
		extravert	introvert	
Animal	cat	4	5	9
	dog	8	3	11
Total		12	8	20

This table shows the total number of subjects for each combination of values of the nominal variables. You will look at different numbers in the output table below depending on whether any cell total is less than 5.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.650[a]	1	.199		
Continuity Correction[b]	.682	1	.409		
Likelihood Ratio	1.664	1	.197		
Fisher's Exact Test				.362	[illegible]
N of Valid Cases	20				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.60.

b. Computed only for a 2x2 table

Use this row if all cell totals above are 5 or greater. (Pearson Chi-Square)

Use this row if any cell total above is less than 5. (Continuity Correction)

How to report the results in APA format:

General format: $X^2(df) = \#.\#\#, p = .\#\#\#$

For this example: $X^2(1) = 0.682, p = .409$

Note: As indicated above, if the total in every cell of the contingency table is 5 or greater, use the results in the "Pearson Chi-Square" row of the output. If the total in any cell is less than 5 (as in this example), use the results in the "Continuity Correction" row of the output.