

Statistical Analysis of Survey Data in JASP: 2 – Likert Scales

1. Overview of Data

id	ID Number	number
ethnicity	Ethnic group	white, Asian, West Indian, African
gender	Your gender	male or female
income	What is your income?	number
age	What is your age?	number
years	How many years have you worked at the company?	number
skill	How skilled are you?	highly skilled, fairly skilled, semi skilled, unskilled
attend	Did you attend the meeting?	yes or no
quality	What is your work quality?	very good, good, average, poor, very poor
commitment	I am committed to my work.	strongly agree, agree, undecided, disagree, strongly disagree
satisfaction	I am satisfied with my work?	strongly agree, agree, undecided, disagree, strongly disagree
autonomy	I can work in my own way.	strongly agree, agree, undecided, disagree, strongly disagree
routine	My routine is flexible.	strongly agree, agree, undecided, disagree, strongly disagree

Likert Scale Items

strongly agree (5), agree (4), undecided (3), disagree (2), strongly disagree (1)

jss with questions* (C:\Users\Andy Gillett\Desktop\JASP\data)														
	ID	ethnicity	gender	age	years	skill	attend	quality	income	commitment	satisfaction	routine	autonomy	
1	1	white	male	29	1	fairly skilled	no	very poor	8300	agree	agree	disagree	disagree	
2	2	asian	male	26	5	fairly skilled	yes	good	7300	disagree	agree	disagree	undecided	
3	3	west indian	male	40	5	highly skilled	yes	good	8900	agree	agree	disagree	disagree	
4	4	west indian	male	46	15	fairly skilled	no	good	8200	disagree	disagree	strongly disagree	undecided	
5	5	asian	female	63	36	fairly skilled	yes	average	9300	agree	undecided	disagree	agree	
6	6	white	male	54	31	unskilled	yes	good	8000	disagree	disagree	disagree	agree	
7	7	white	male	29	2	fairly skilled	no	poor	8300	not reported	undecided	disagree	undecided	
8	8	west indian	male	35	2	fairly skilled	no	good	8800	strongly agree	disagree	undecided	undecided	
9	9	asian	female	33	4	semi-skilled	no	very poor	8800	undecided	undecided	disagree	disagree	
10	10	asian	female	27	6	semi-skilled	yes	good	6900	agree	undecided	disagree	undecided	
11	11	white	male	29	4	semi-skilled	no	average	7100	disagree	disagree	disagree	strongly agree	
12	12	asian	male	19	2	fairly skilled	yes	average	.	strongly disagree	strongly disagree	strongly disagree	undecided	
13	13	african	male	55	35	highly skilled	yes	very good	9000	undecided	undecided	disagree	strongly agree	
14	14	white	female	29	1	unskilled	yes	poor	8500	disagree	undecided	disagree	agree	
15	15	west indian	male	48	8	highly skilled	no	very good	9100	undecided	undecided	undecided	disagree	
16	16	asian	male	32	7	semi-skilled	no	average	7900	undecided	undecided	disagree	agree	
17	17	white	male	48	14	semi-skilled	yes	average	8300	undecided	undecided	strongly disagree	agree	
18	18	white	female	18	1	semi-skilled	yes	average	6700	disagree	disagree	disagree	strongly agree	
19	19	west indian	female	28	2	fairly skilled	no	good	7500	agree	agree	undecided	undecided	
20	20	west indian	female	37	1	unskilled	yes	very poor	8800	undecided	disagree	undecided	strongly agree	

2. Frequencies - Job Satisfaction

How often are the various options chosen on, for example, the job satisfaction scale?

[Analyses → Descriptives → Descriptive Statistics → Tables → Frequency Tables]

The screenshot shows the SPSS interface with the 'Descriptive Statistics' and 'Frequency Tables' output for the 'satisfaction' variable. The 'Descriptive Statistics' table shows the following values:

Descriptive Statistics	
	satisfaction
Valid	70
Missing	0
Mean	
Std. Deviation	
Minimum	agree
Maximum	undecided

The 'Frequency Tables' table shows the following values:

Frequencies for satisfaction				
satisfaction	Frequency	Percent	Valid Percent	Cumulative Percent
agree	15	21.4	21.4	21.4
disagree	22	31.4	31.4	52.9
strongly agree	2	2.9	2.9	55.7
strongly disagree	7	10.0	10.0	65.7
undecided	24	34.3	34.3	100.0
Missing	0	0.0		
Total	70	100.0		

Frequencies for satisfaction

satisfaction	Frequency	Percent	Valid Percent	Cumulative Percent
agree	15	21.4	21.4	21.4
disagree	22	31.4	31.4	52.9
strongly agree	2	2.9	2.9	55.7
strongly disagree	7	10.0	10.0	65.7
undecided	24	34.3	34.3	100.0
Missing	0	0.0		
Total	70	100.0		

According to gender

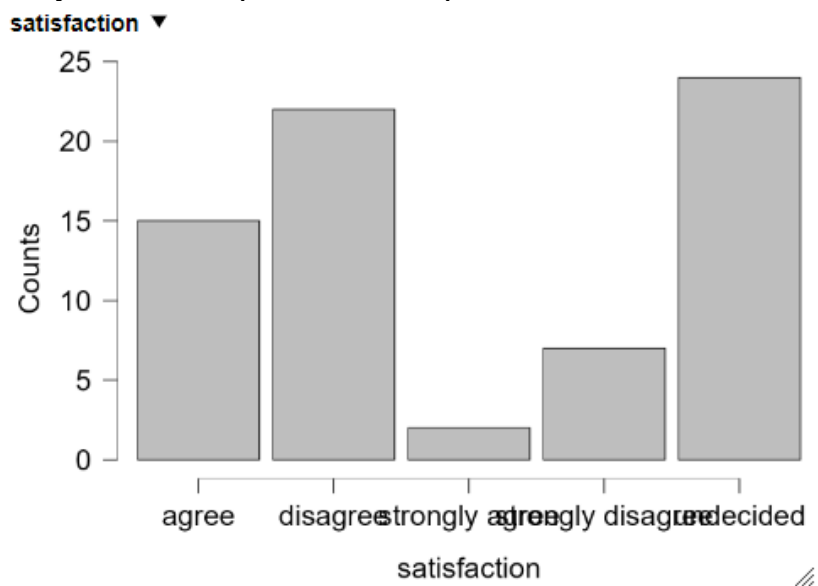
Frequency Tables ▾

Frequencies for satisfaction

gender	satisfaction	Frequency	Percent	Valid Percent	Cumulative Percent
female	agree	7	22.6	22.6	22.6
	disagree	8	25.8	25.8	48.4
	strongly agree	0	0.0	0.0	48.4
	strongly disagree	4	12.9	12.9	61.3
	undecided	12	38.7	38.7	100.0
	Missing	0	0.0		
male	agree	8	20.5	20.5	20.5
	disagree	14	35.9	35.9	56.4
	strongly agree	2	5.1	5.1	61.5
	strongly disagree	3	7.7	7.7	69.2
	undecided	12	30.8	30.8	100.0
	Missing	0	0.0		
Total		39	100.0		

Or you could draw a Bar Graph

[Analyses -> Descriptives -> Descriptive Statistics -> Basic Plots -> Distribution Plots]



Change Order

Name: Long name:

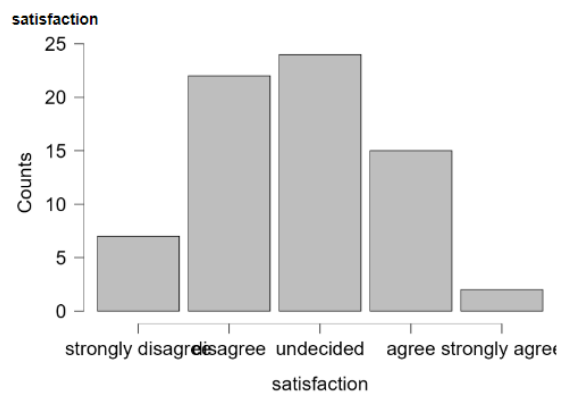
Column type: Description:

Computed type:

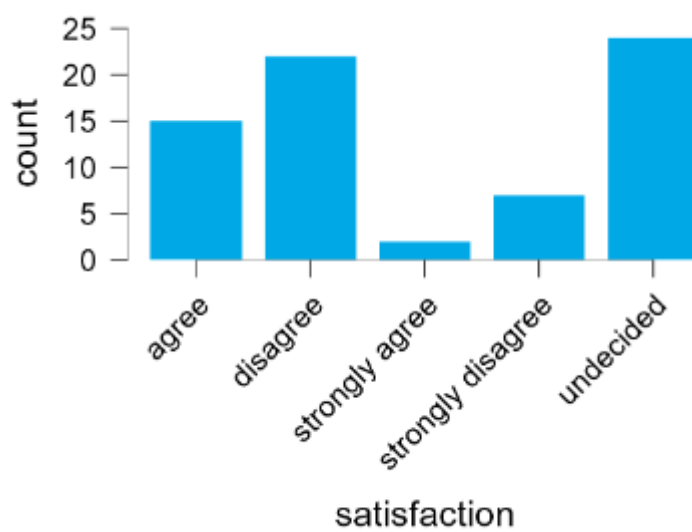
Label editor

Filter	Value	Label
✓	agree	agree
✓	disagree	disagree
✓	strongly agree	strongly agree
✓	strongly disagree	strongly disagree
✓	undecided	undecided

Distribution Plots



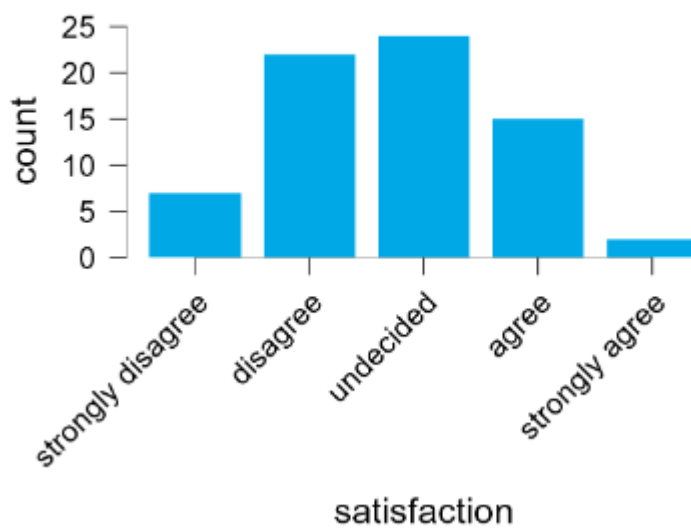
You can use Plot Builder to edit it more [Analyses -> Descriptives -> Plot Builder]



Or

Plots

Plot 1



3. Tables

You can draw various tables from the data.

[Analyses -> Frequencies – Contingency Tables]

e.g. Satisfaction vs gender

The screenshot shows the SPSS 'Frequencies' dialog box with 'Contingency Tables' selected. The 'Rows' list contains 'routine' and the 'Columns' list contains 'gender'. The 'Statistics' section is expanded, showing 'Cells' and 'Options'. The 'Contingency Tables' output window displays the following table:

routine	gender		Total
	female	male	
agree	2	3	5
disagree	15	19	34
strongly agree	0	2	2
strongly disagree	4	4	8
undecided	10	11	21
Total	31	39	70

Note: Each cell displays the observed counts

Satisfaction vs ethnicity

Contingency Tables

Contingency Tables

routine	ethnicity				Total
	african	asian	west indian	white	
agree	0	1	1	3	5
disagree	2	9	3	20	34
strongly agree	0	1	0	1	2
strongly disagree	0	3	4	1	8
undecided	0	4	6	11	21
Total	2	18	14	36	70

Note: Each cell displays the observed counts

Satisfaction vs gender & ethnicity

jss with questions* (C:\Users\Andy Gillett\Desktop\JASP\data)

Edit Data Descriptives T-Tests ANOVA Mixed Models Regression Frequencies Factor

Descriptive Statistics

Contingency Tables

Rows: satisfaction

Columns: ethnicity

Counts:

Layers: Layer 1: gender, Layer 2:

Statistics: Cells: Options:

Contingency Tables

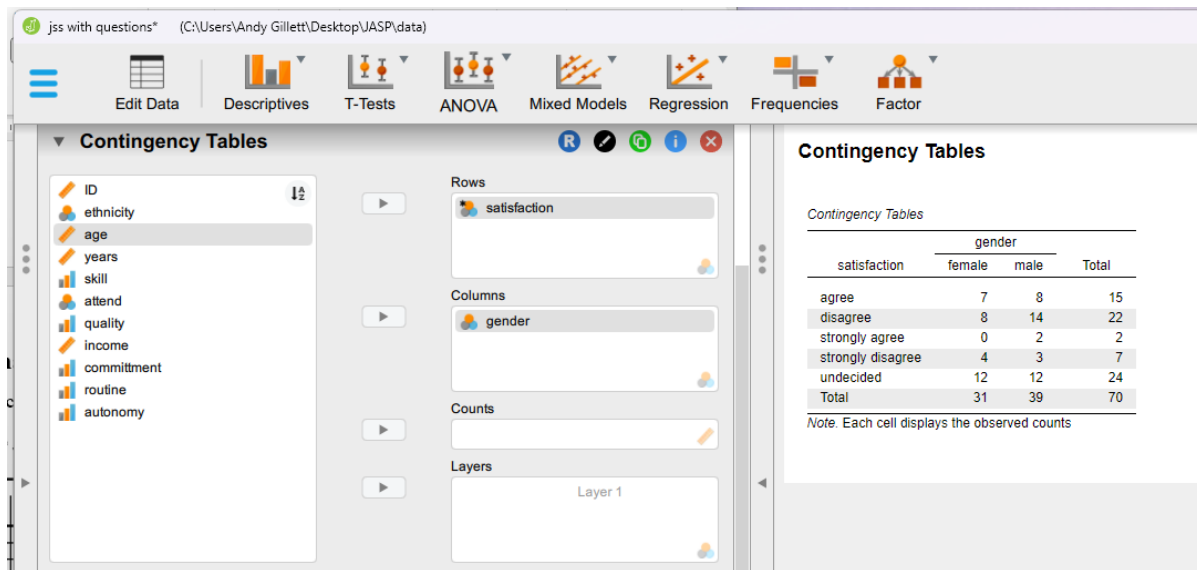
Contingency Tables

gender	satisfaction	ethnicity				Total
		african	asian	west indian	white	
female	agree	0	2	2	3	7
	disagree	0	1	2	5	8
	strongly agree	0	0	0	0	0
	strongly disagree	0	1	1	2	4
male	undecided	1	6	1	4	12
	Total	1	10	6	14	31
	agree	0	2	1	5	8
	disagree	0	2	5	7	14
Total	strongly agree	0	0	0	2	2
	strongly disagree	0	1	0	2	3
	undecided	1	3	2	6	12
	Total	1	8	8	22	39
Total	agree	0	4	3	8	15
	disagree	0	3	7	12	22
	strongly agree	0	0	0	2	2
	strongly disagree	0	2	1	4	7
Total	undecided	2	9	3	10	24
	Total	2	18	14	36	70

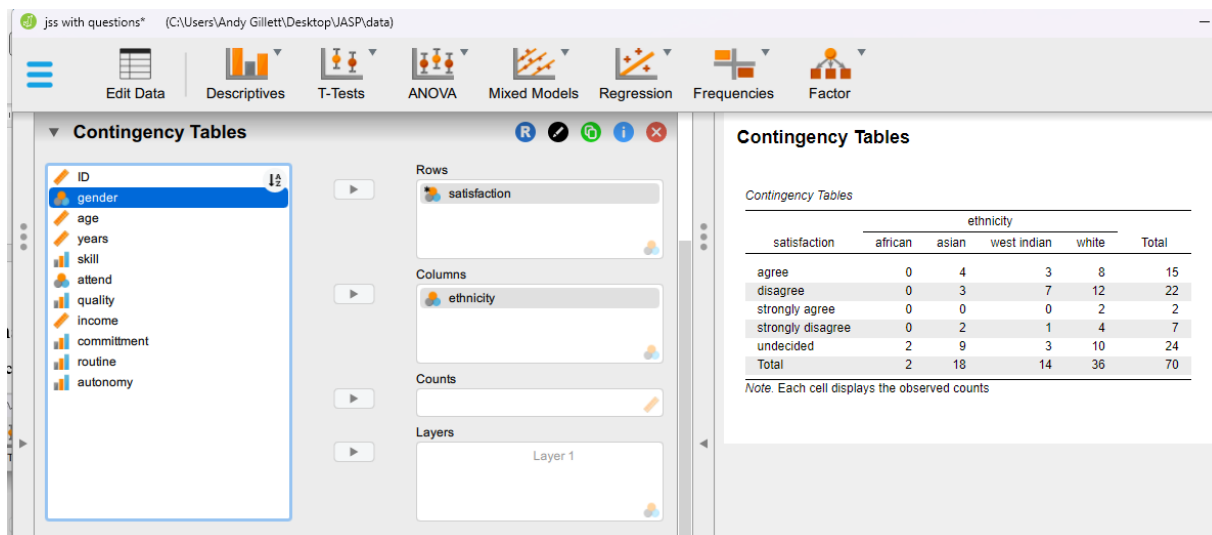
Note. Each cell displays the observed counts

4. How do Males and Females Judge Job Satisfaction?

[Analyses -> Descriptive Statistics ->Contingency Tables]

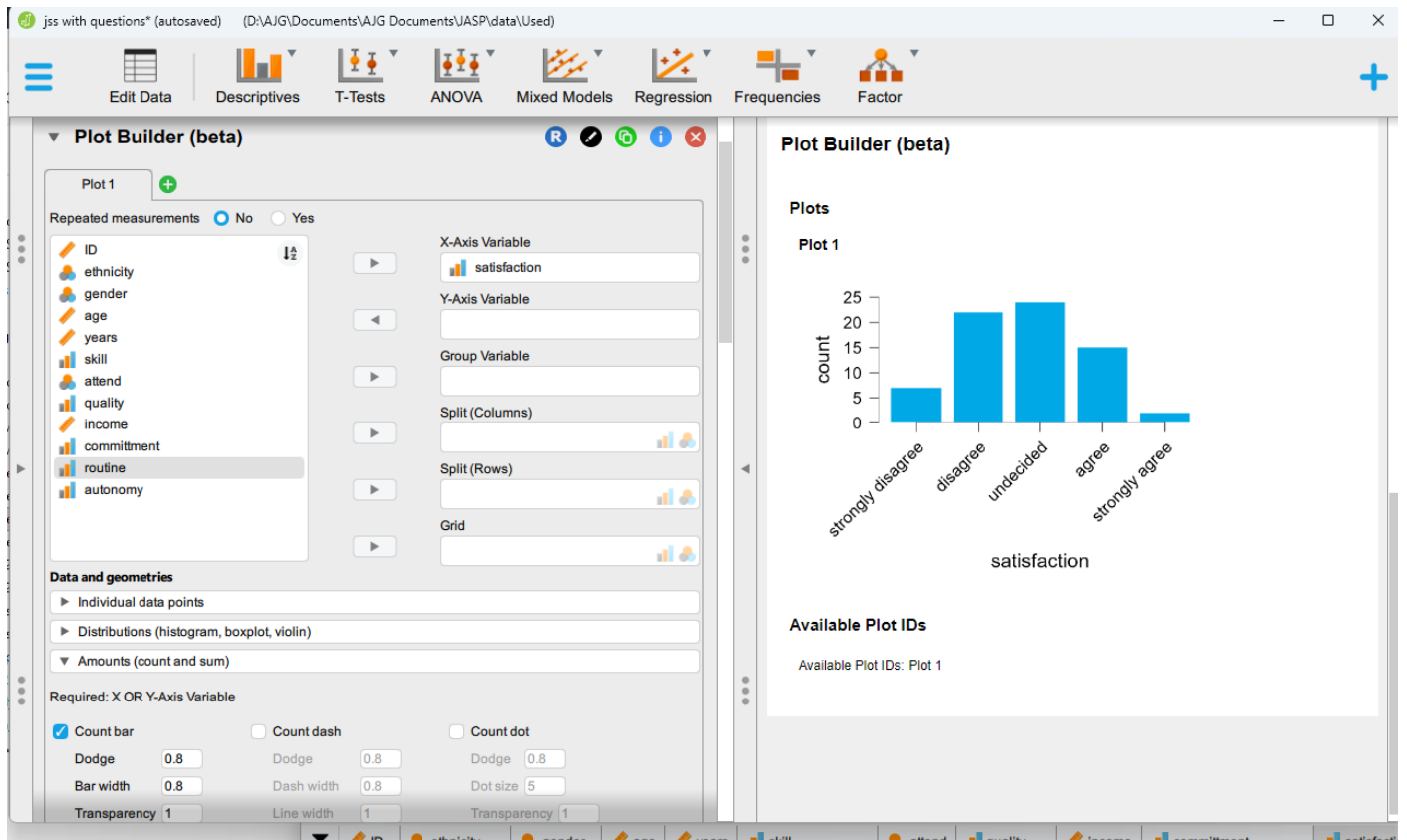


Or different ethnic groups?



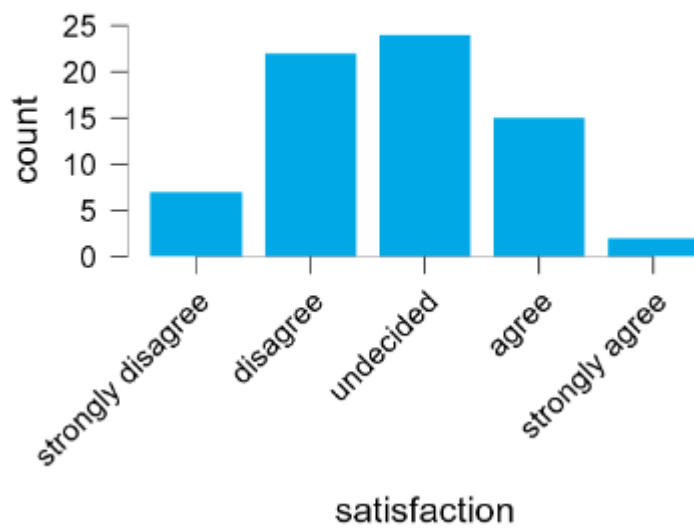
We can diagram these.

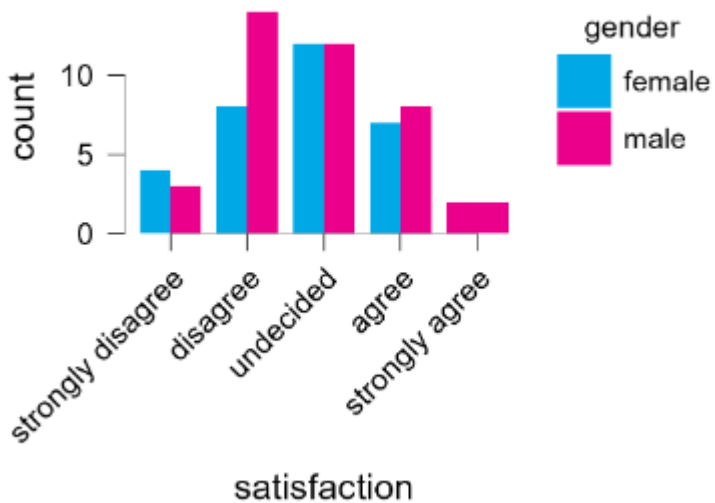
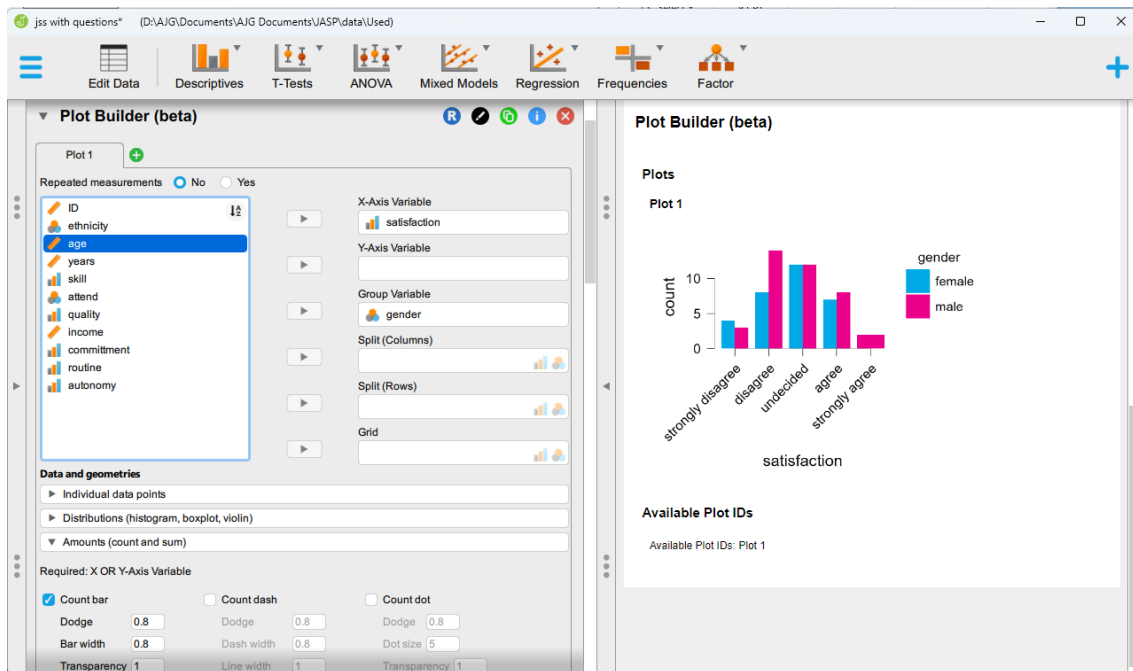
Overall [Analyses -> Descriptives -> Plot Builder]

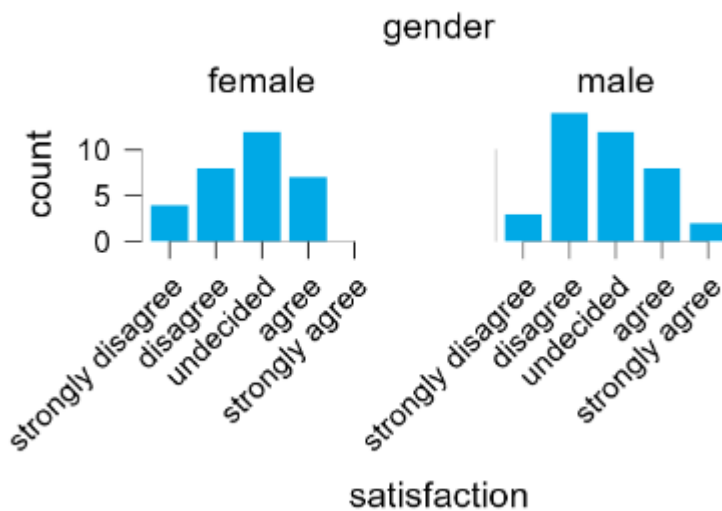
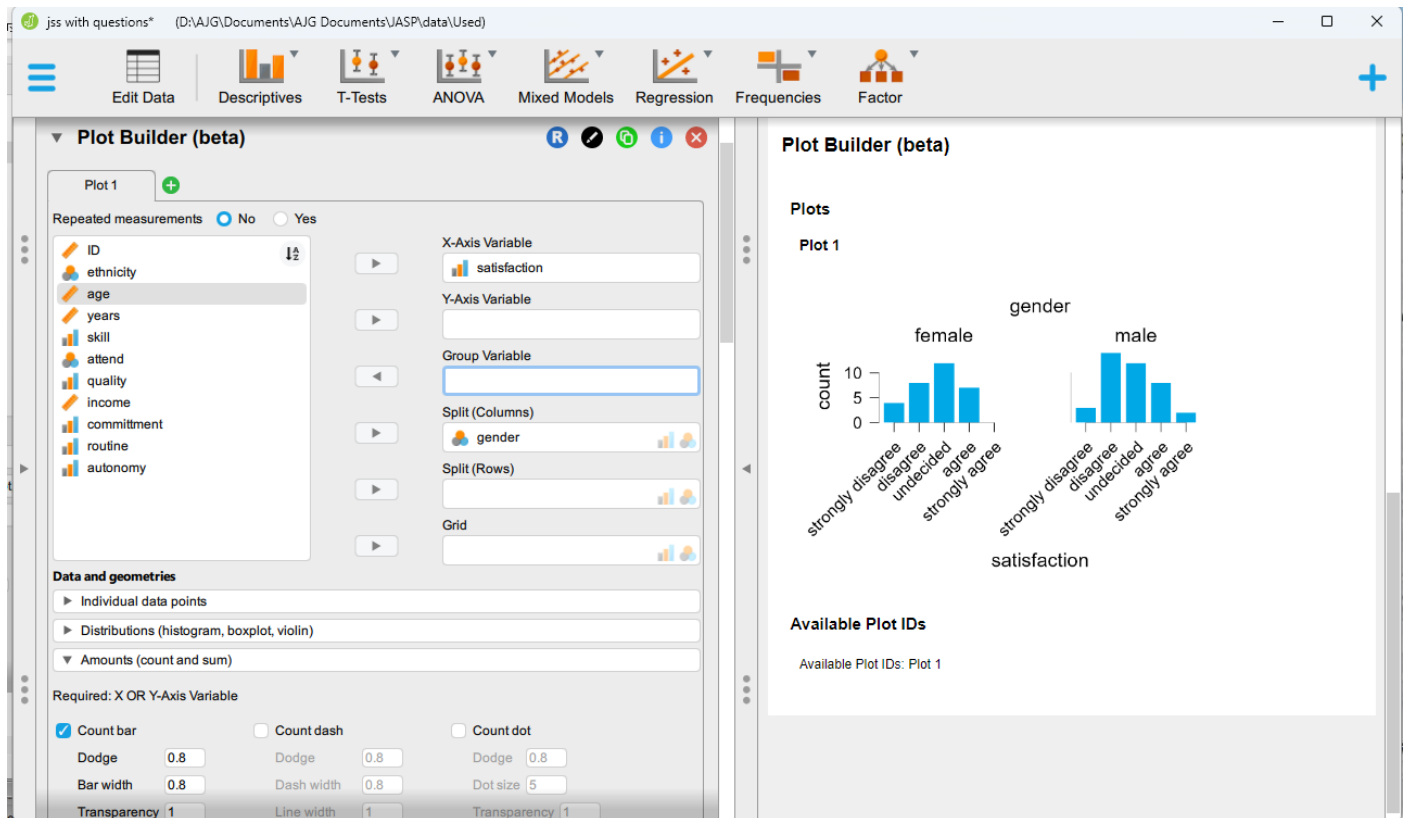


Plots ▾

Plot 1 ▾







What about statistical; evidence for this. Are males and females different with regard to job satisfaction?

In this case we need numbers

jss with questions numbers (C:\Users\Andy Gillett\Desktop\JASP\data)

	Did you attend the meeting?	What is your work quality?	How much do you Earn?	I am comitted to my work.	I am satisfied with my work?	I can work in my own way.	My routine is flexible.
1	no	very poor	8300	4	4	2	2
2	yes	good	7300	2	2	2	3
3	yes	good	8900	4	4	2	2
4	no	good	8200	2	2	1	3
5	yes	average	9300	4	3	2	4
6	yes	good	8000	2	2	2	4
7	no	poor	8300	2	3	2	3
8	no	good	8800	5	2	3	3
9	no	very poor	8800	3	3	2	2
10	yes	good	8900	4	3	2	3
11	no	average	7100	2	2	2	5
12	yes	average	6900	1	1	1	3
13	yes	very good	9000	3	3	2	5
14	yes	poor	8500	2	3	2	4
15	no	very good	9100	3	3	3	2
16	no	average	7900	3	3	2	4
17	yes	average	8300	3	3	1	4
18	yes	average	6700	2	2	2	5
19	no	good	7500	4	4	3	3
20	yes	very poor	8800	3	2	3	5

[Analysis -> T-Test -> Independent Samples T-Test]

jss with questions numbers* (C:\Users\Andy Gillett\Desktop\JASP\data)

Edit Data | Descriptives | T-Tests | ANOVA | Mixed Models | Regression | Frequencies | Factor

Descriptive Statistics

Independent Samples T-Test

ID Number
 Ethnic group
 What is your income?
 What is your age?
 How many years have you worke...
 How skilled are you?
 Did you attend the meeting?
 What is your work quality?
 How much do you Earn?
 I am comitted to my work

Dependent Variables
 I am satisfied with my work?

Grouping Variable
 Your gender

Tests
☐ Student
☐ Welch
☒ Mann-Whitney

Additional Statistics
☐ Location parameter
☐ Confidence interval 95 %
☐ Effect size

Independent Samples T-Test

Independent Samples T-Test

	U	df	p
I am satisfied with my work?	612.5		.926

Note. Mann-Whitney U test.

Choose Mann-Whitney for 2 Ordinal Variable.

Significance = 0.926 so there is no statistically significant difference between males and females with regard to job satisfaction.

Effect Size – Very Low

jss with questions numbers* (C:\Users\Andy Gillett\Desktop\JASP\data)

Edit Data

Descriptives

T-Tests

ANOVA

Mixed Models

Regression

Frequencies

Factor

Independent Samples T-Test

ID Number

Ethnic group

What is your income?

What is your age?

How many years have you worke...

How skilled are you?

Did you attend the meeting?

What is your work quality?

How much do you Earn?

I am comitted to my work

Dependent Variables

I am satisfied with my work?

Grouping Variable

Your gender

Tests

☐ Student

☐ Welch

☒ Mann-Whitney

Alternative Hypothesis

☒ Group 1 ≠ Group 2

☐ Group 1 > Group 2

☐ Group 1 < Group 2

Assumption Checks

☐ Normality

☐ Equality of variances

Brown-Forsythe

Levene's

Additional Statistics

☐ Location parameter

☐ Confidence interval

95

%

☒ Effect size

☒ Cohen's d

☐ Glass' delta

☐ Hedges' g

☐ Confidence interval

95

%

☐ Descriptives

☐ Vovk-Sellke maximum p-ratio

Plots

☐ Descriptives plots

☐ Raincloud plots

Horizontal display

Independent Samples T-Test

Independent Samples T-Test

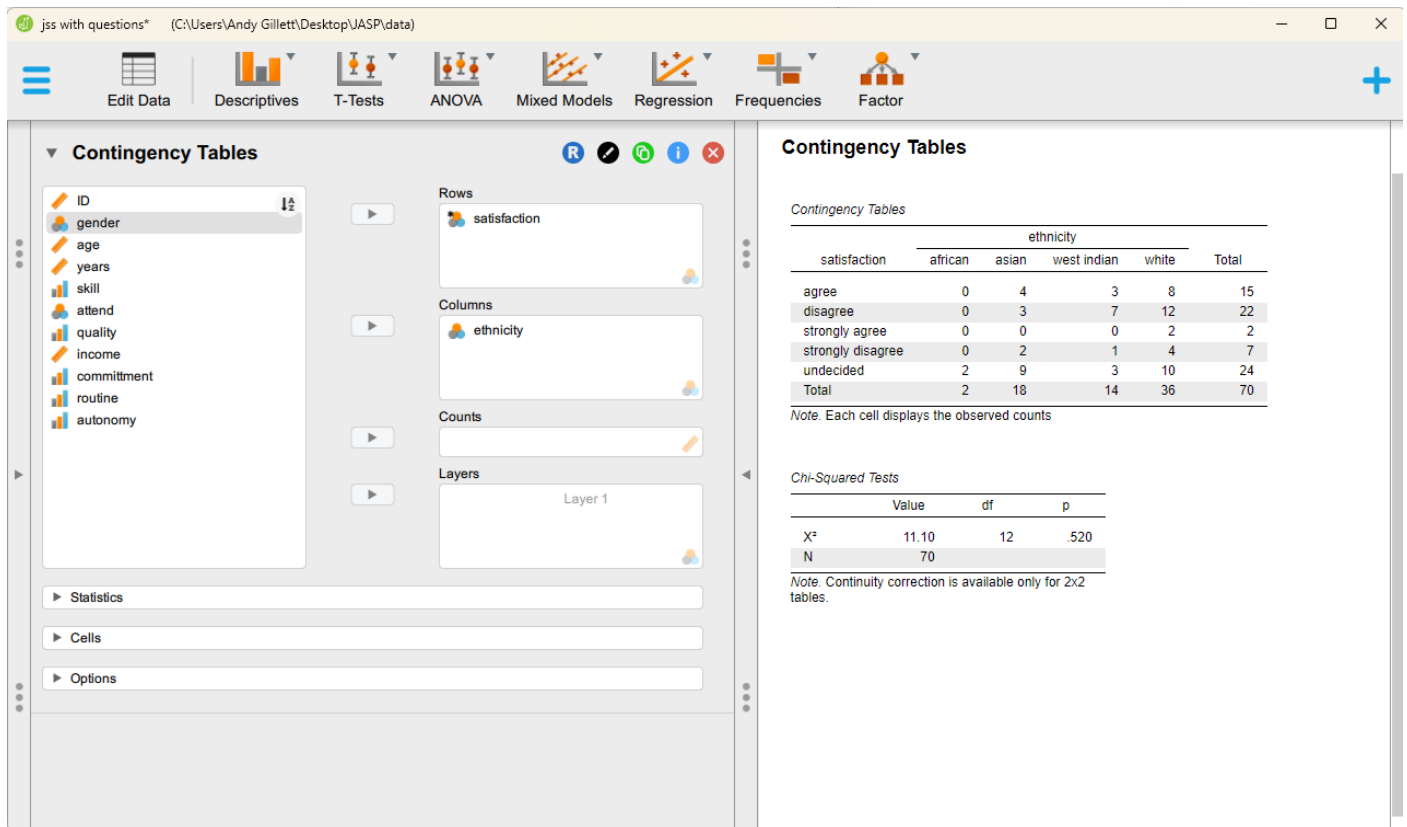
	U	df	p	Rank-Biserial Correlation
I am satisfied with my work?	612.5		.926	-0.013

Note. For the Mann-Whitney test, effect size is given by the rank biserial correlation.

Note. Mann-Whitney U test.

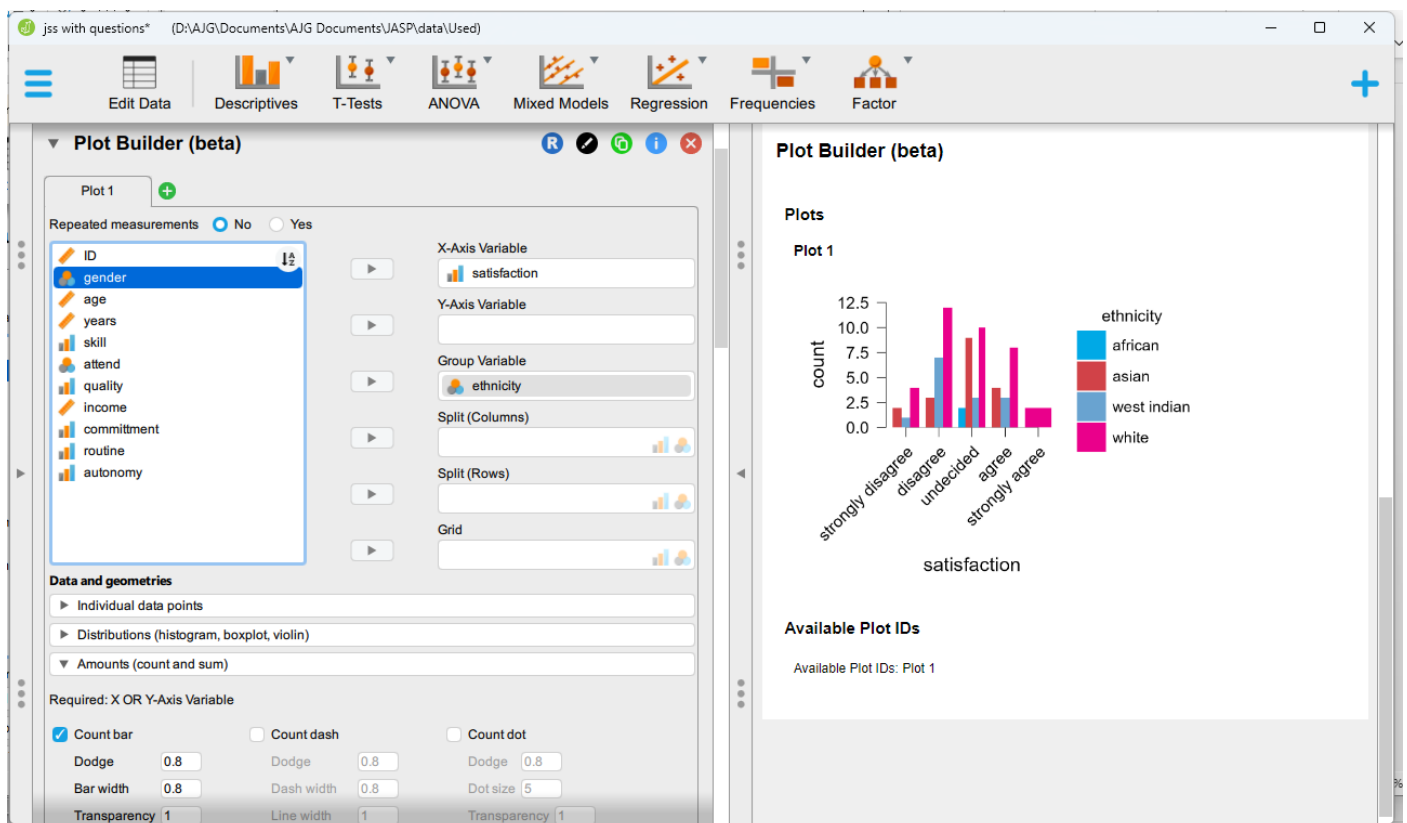
5. How do different Ethnicities Judge Job Satisfaction?

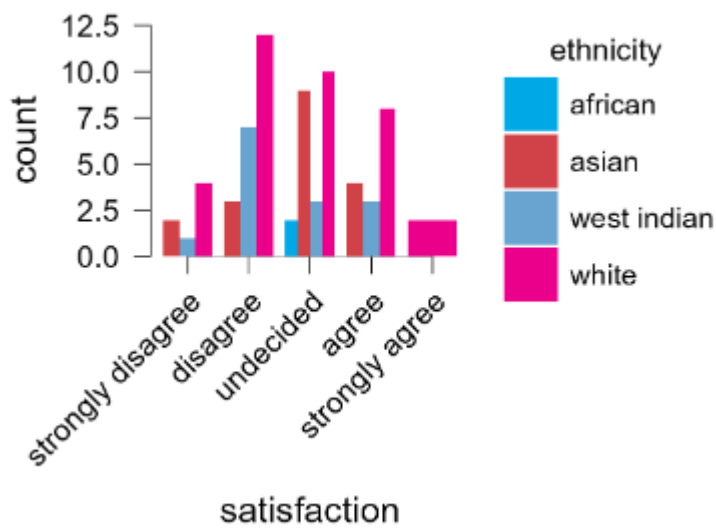
[Analyses -> Descriptive Statistics -> Contingency Tables]



We can diagram these.

Overall [Analyse -> Descriptives -> Plot Builder]





What about statistical; evidence for this. Are different ethnicities different with regard to job satisfaction?

Again we need numbers

jss with questions numbers (C:\Users\Andy Gillett\Desktop\JASP\data)							
	Analyses	Synchronisation	Resize Data	Insert	Remove	Undo	Redo
	Did you attend the meeting?	What is your work quality?	How much do you Earn?	I am comitted to my work.	I am satisfied with my work?	I can work in my own way.	My routine is flexible.
1	no	very poor	8300	4	4	2	2
2	res	good	7300	2	2	2	3
3	res	good	8900	4	4	2	2
4	no	good	8200	2	2	1	3
5	res	average	9300	4	3	2	4
6	res	good	8000	2	2	2	4
7	no	poor	8300	2	3	2	3
8	no	good	8800	5	2	3	3
9	no	very poor	8800	3	3	2	2
10	res	good	6900	4	3	2	3
11	no	average	7100	2	2	2	5
12	res	average	6900	1	1	1	3
13	res	very good	9000	3	3	2	5
14	res	poor	8500	2	3	2	4
15	no	very good	9100	3	3	3	2
16	no	average	7900	3	3	2	4
17	res	average	8300	3	3	1	4
18	res	average	6700	2	2	2	5
19	no	good	7500	4	4	3	3
20	res	very poor	8800	3	2	3	5

[Analyses -> ANOVA -> ANOVA]

ANOVA

ID Number

Your gender

What is your income?

What is your age?

How many years have you worked ...

How skilled are you?

Did you attend the meeting?

What is your work quality?

How much do you Earn?

I am comitted to my work.

I can work in my own way.

My routine is flexible.

Dependent Variable

I am satisfied with my work?

Fixed Factors

Ethnic group

WLS Weights

Display

Descriptive statistics

Estimates of effect size

ω^2

partial ω^2

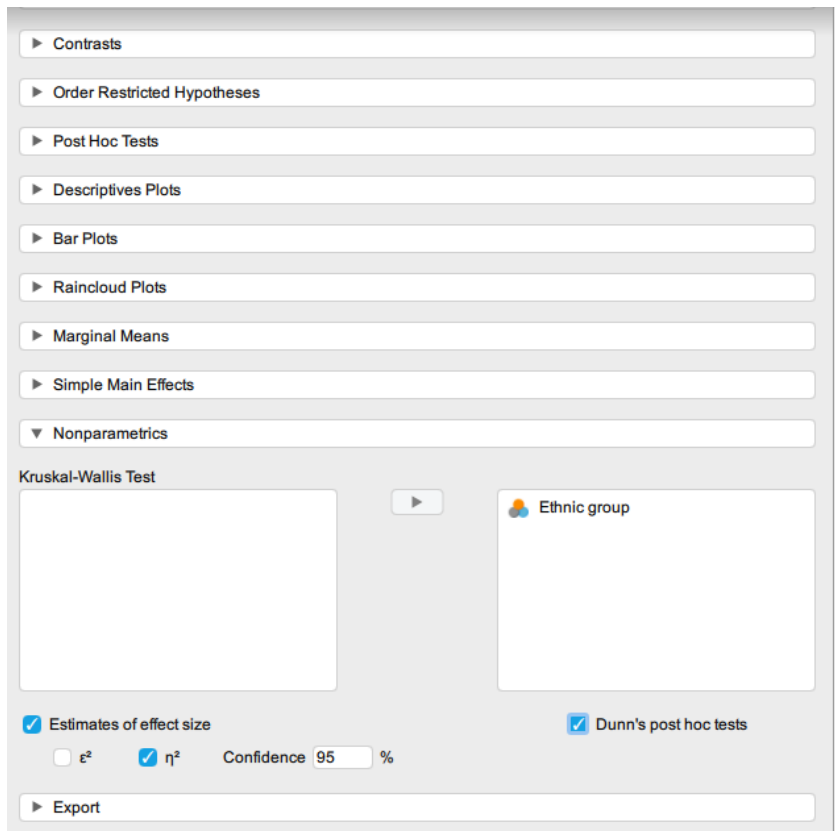
η^2

partial η^2

Confidence intervals 95 %

Vovk-Sellike maximum p-ratio

We need Nonparametric statistics for ordinal data



The image shows the SPSS Nonparametric Test: Kruskal-Wallis Test configuration window. It includes a list of options on the left: Contrasts, Order Restricted Hypotheses, Post Hoc Tests, Descriptives Plots, Bar Plots, Raincloud Plots, Marginal Means, Simple Main Effects, and Nonparametrics (expanded). The main area shows the Kruskal-Wallis Test for the factor 'Ethnic group'. Below the test name, there are checkboxes for 'Estimates of effect size' (selected) and 'Dunn's post hoc tests' (selected). Under 'Estimates of effect size', there are checkboxes for ϵ^2 (unselected) and η^2 (selected), with a 'Confidence' level of 95%.

Choose Kruskal-Wallis test, Effect Size & Post Hoc test

Kruskal-Wallis Test

Kruskal-Wallis Test

Factor	Statistic	df	p	Rank η^2	95% CI for Rank η^2	
					Lower	Upper
Ethnic group	0.749	3	.862	0.000	0.000	0.106

Significance = .862 so there is no statistically significant difference between ethnicities with regard to job satisfaction.

Effect Size (eta squared) – Very Low

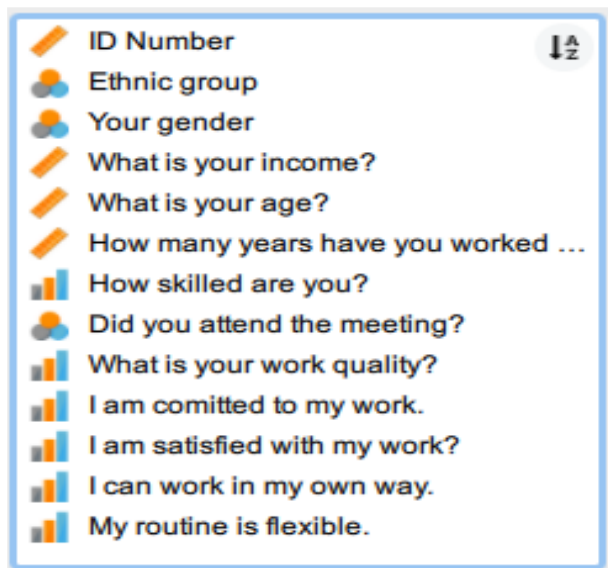
No significance so Post Hoc not useful

6. Multiple Regression – Job Satisfaction

Again we need numbers

What contributes to job satisfaction? Income, Gender, etc?

This is our data.



Look at correlations – Spearman, not Pearson.

[Analyses -> Regression -> Correlation]

Spearman's Correlations

			Spearman's rho	p
satisfaction	-	ethnicgp	-0.160	.186
satisfaction	-	gender	0.067	.584
satisfaction	-	income	-0.564	< .001
satisfaction	-	age	-0.333	.005
satisfaction	-	years	-0.197	.103
satisfaction	-	skill	-0.438	< .001
ethnicgp	-	gender	0.081	.506
ethnicgp	-	income	0.039	.751
ethnicgp	-	age	-0.108	.376
ethnicgp	-	years	-0.073	.549
ethnicgp	-	skill	0.142	.242
gender	-	income	-0.081	.510
gender	-	age	-0.029	.816
gender	-	years	0.064	.598
gender	-	skill	-0.189	.117
income	-	age	0.633	< .001
income	-	years	0.296	.014
income	-	skill	0.279	.021
age	-	years	0.763	< .001
age	-	skill	0.145	.233
years	-	skill	0.064	.599

Spearman's Correlations ▼

			Spearman's rho	p
satisfaction	-	ethnicgp	-0.160	.186
satisfaction	-	gender	0.067	.584
satisfaction	-	income	-0.564	< .001
satisfaction	-	age	-0.333	.005
satisfaction	-	years	-0.197	.103
satisfaction	-	skill	-0.438	< .001

We can see that, for example, there is a strong significant correlation between job satisfaction and income (0.564), age (0.333) and skill (0.438).

Multiple Regression

[Analyses -> Regression -> Linear Regression]

The screenshot shows the 'Linear Regression' analysis window in the jss-edited* software. The dependent variable is 'satisfaction'. The method is 'Enter'. The covariates are 'ethnicgp', 'gender', 'income', 'age', 'years', and 'skill'. The WLS Weights (optional) are empty. The results are displayed on the right side of the window.

Model Summary - satisfaction

Model	R	R ²	Adjusted R ²	RMSE
M ₀	0.000	0.000	0.000	1.122
M ₁	0.644	0.414	0.356	0.900

Note. M₁ includes ethnicgp, gender, income, age, years, skill

ANOVA

Model	Sum of Squares	df	Mean Square	F	p
M ₁ Regression	34.43	6	5.738	7.078	< .001
Residual	48.65	60	0.811		
Total	83.07	66			

Note. M₁ includes ethnicgp, gender, income, age, years, skill
Note. The intercept model is omitted, as no meaningful information can be shown.

Coefficients

Model	Unstandardized	Standard Error	Standardized	t	p
M ₀ (Intercept)	3.209	0.137		23.412	< .001
M ₁ (Intercept)	8.043	1.006		7.994	< .001
ethnicgp	-0.133	0.129	-0.106	-1.033	.306
gender	0.071	0.225	0.032	0.314	.754
income	-5.043×10 ⁻⁴	1.542×10 ⁻⁴	-0.447	-3.270	.002
age	0.005	0.018	0.060	0.301	.764
years	-0.011	0.017	-0.107	-0.642	.523
skill	-0.324	0.115	-0.307	-2.809	.007

Model Summary - satisfaction ▼

Model	R	R ²	Adjusted R ²	RMSE
M ₀	0.000	0.000	0.000	1.122
M ₁	0.644	0.414	0.356	0.900

Note. M₁ includes ethnicgp, gender, income, age, years, skill

R=0.644 – there is a strong correlation between the factors chosen and job satisfaction.

The model predicts well

Coefficients ▼

Model		Unstandardized	Standard Error	Standardized	t	p
M ₀	(Intercept)	3.209	0.137		23.412	< .001
M ₁	(Intercept)	8.043	1.006		7.994	< .001
	ethnicgp	-0.133	0.129	-0.106	-1.033	.306
	gender	0.071	0.225	0.032	0.314	.754
	income	-5.043×10 ⁻⁴	1.542×10 ⁻⁴	-0.447	-3.270	.002
	age	0.005	0.018	0.060	0.301	.764
	years	-0.011	0.017	-0.107	-0.642	.523
	skill	-0.324	0.115	-0.307	-2.809	.007

Income and Skill are significant

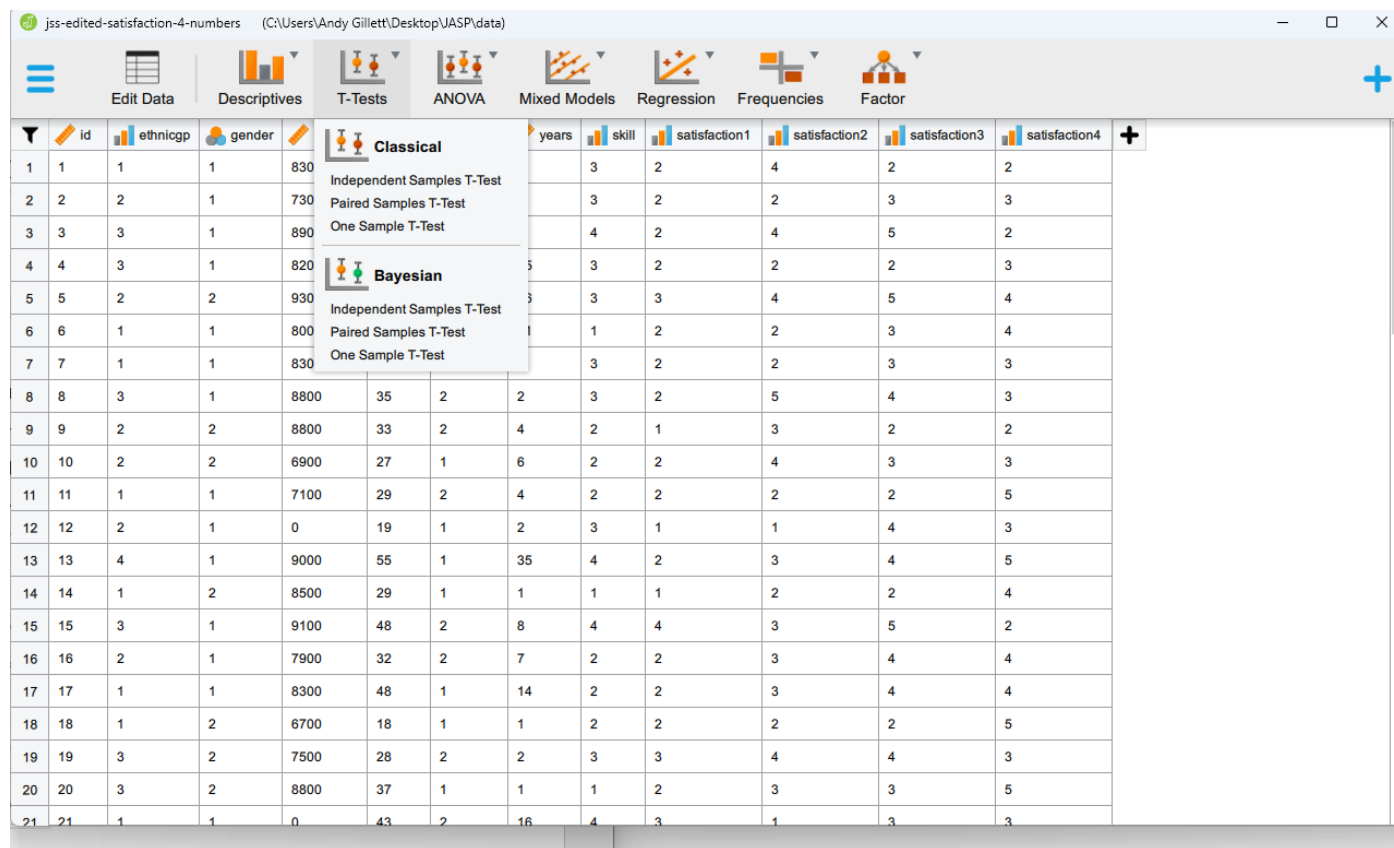
The most important predictor of job satisfaction is income – standardised coefficient is 0.45 followed by rated skill at 0.3

The regression equation Job Satisfaction = -8.043 – 0.0005 x income -0.324 x skill

7. Changes in Job Satisfaction over time

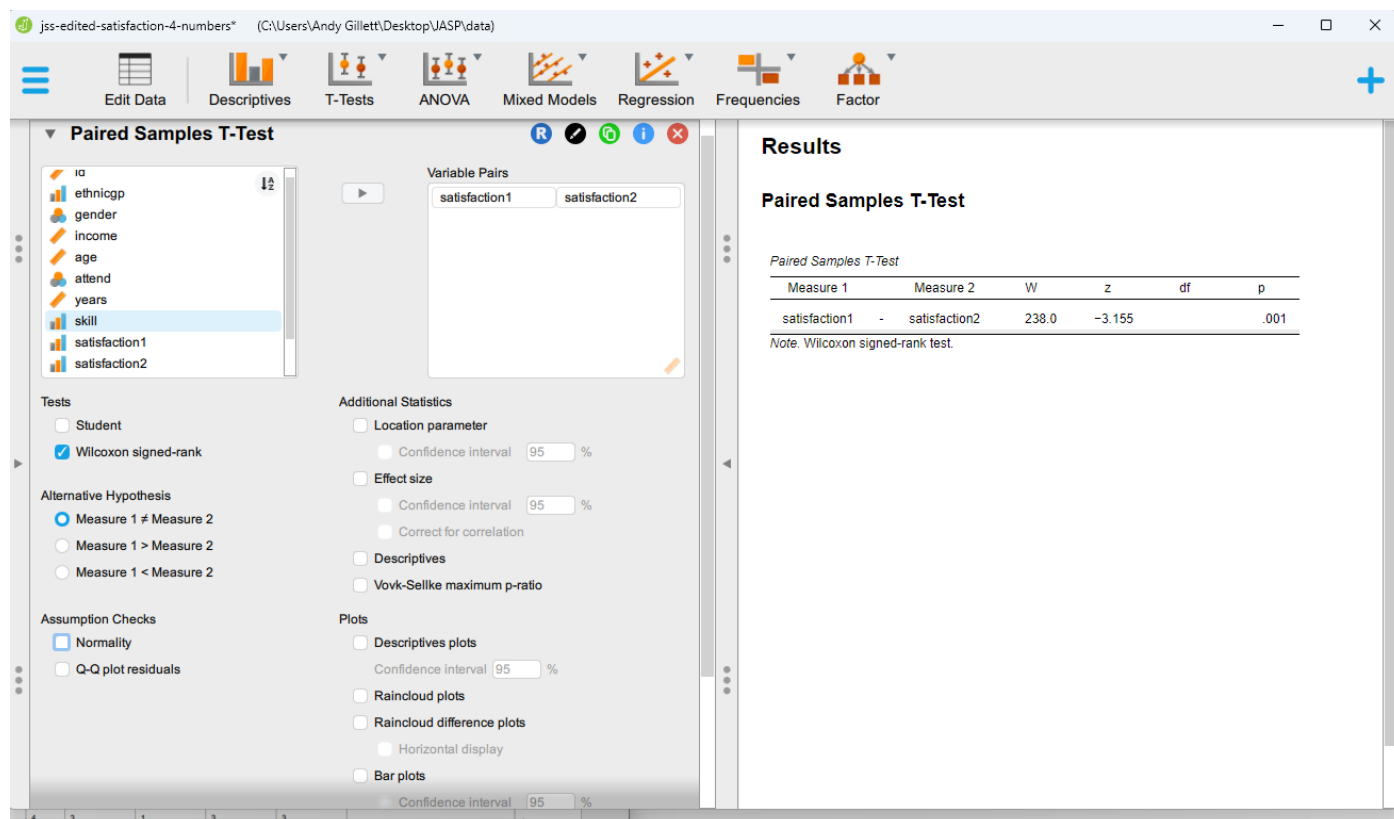
What about changes in Job Satisfaction at two different times?

[Analyses -> T-Tests -> Paired Samples T-Test]



	id	ethnicgp	gender		years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4		
1	1	1	1	830		3	2	4	2	2		
2	2	2	1	730		3	2	2	3	3		
3	3	3	1	890		4	2	4	5	2		
4	4	3	1	820		3	2	2	2	3		
5	5	2	2	930		3	3	4	5	4		
6	6	1	1	800		1	2	2	3	4		
7	7	1	1	830		3	2	2	3	3		
8	8	3	1	8800	35	2	2	3	2	5	4	3
9	9	2	2	8800	33	2	4	2	1	3	2	2
10	10	2	2	6900	27	1	6	2	2	4	3	3
11	11	1	1	7100	29	2	4	2	2	2	2	5
12	12	2	1	0	19	1	2	3	1	1	4	3
13	13	4	1	9000	55	1	35	4	2	3	4	5
14	14	1	2	8500	29	1	1	1	1	2	2	4
15	15	3	1	9100	48	2	8	4	4	3	5	2
16	16	2	1	7900	32	2	7	2	2	3	4	4
17	17	1	1	8300	48	1	14	2	2	3	4	4
18	18	1	2	6700	18	1	1	2	2	2	2	5
19	19	3	2	7500	28	2	2	3	3	4	4	3
20	20	3	2	8800	37	1	1	1	2	3	3	5
21	21	1	1	0	43	2	16	4	3	1	3	3

Choose Wilcoxon matched-pair signed-rank test for ordinal data.



Paired Samples T-Test						
Measure 1	Measure 2	W	z	df	p	
satisfaction1	- satisfaction2	238.0	-3.155		.001	Note. Wilcoxon signed-rank test.

Paired Samples T-Test

Paired Samples T-Test

Measure 1		Measure 2	W	z	df	p
satisfaction1	-	satisfaction2	238.0	-3.155		.001

Note. Wilcoxon signed-rank test.

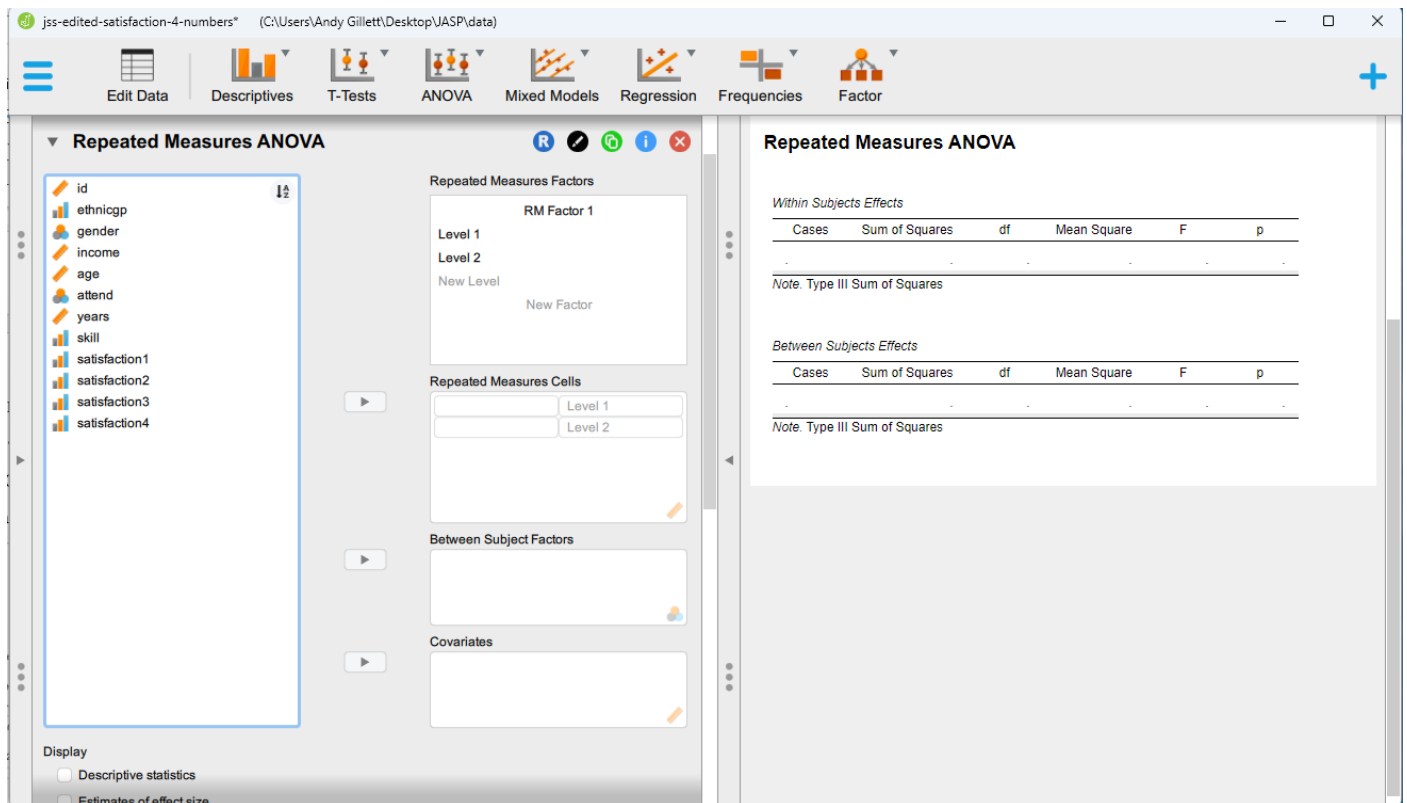
Satisfaction 1 = Time 1, Satisfaction 2 = Time 2

Significance = 0.001 so there is a statistically significant difference between job satisfaction at the two times.

8. Job Satisfaction at several Different Times during a Project

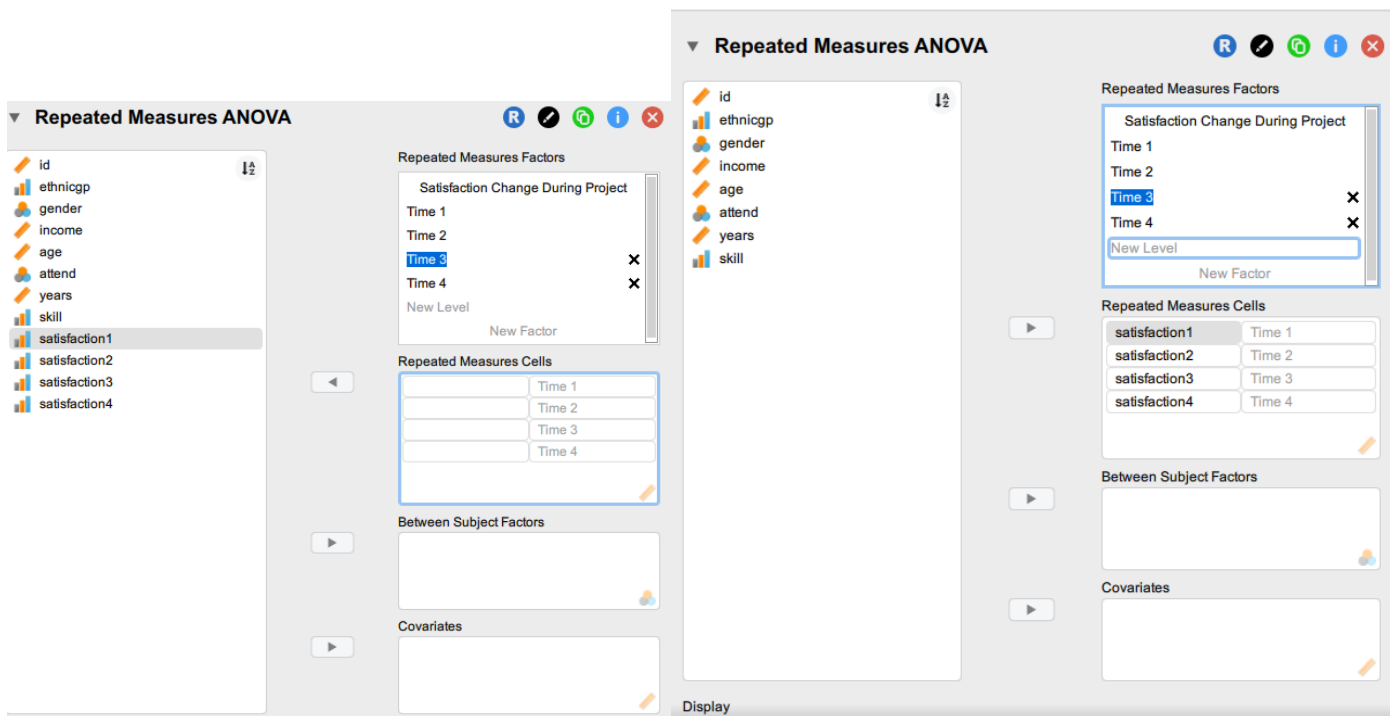
Do workers change their job satisfaction scores during a project?

[Analyses -> ANOVA -> Repeated Measures ANOVA]

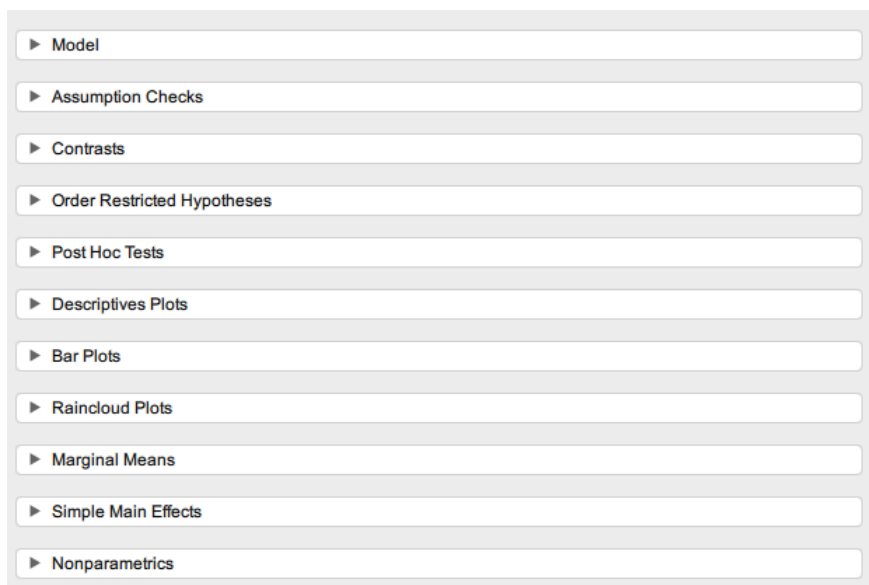


Change Title: Satisfaction Change Puring Project

Define 4 Levels – Time 1-4. Move the data in Satisfaction 1-4.

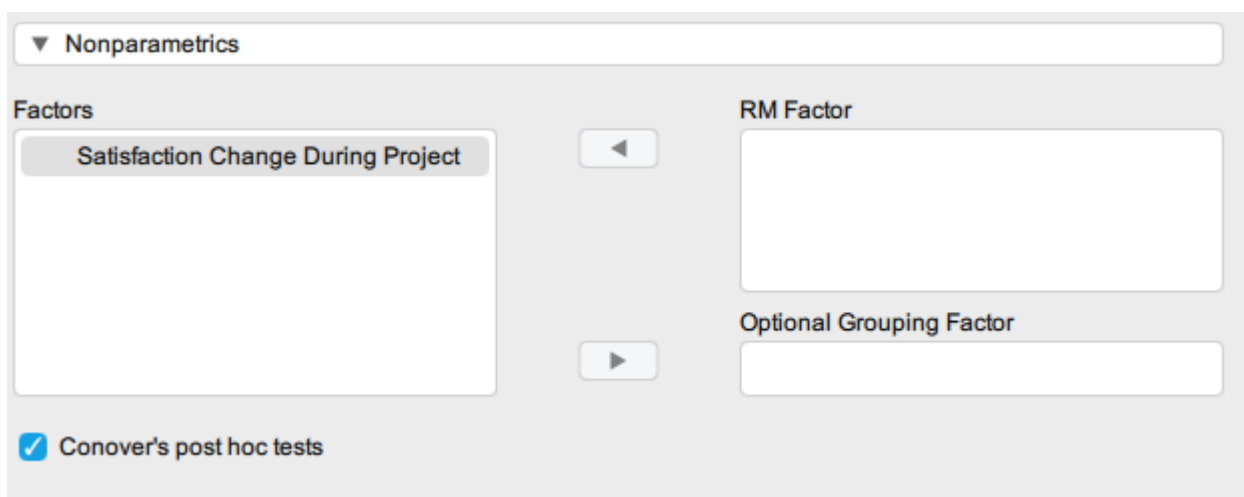


Choose Nonparametric

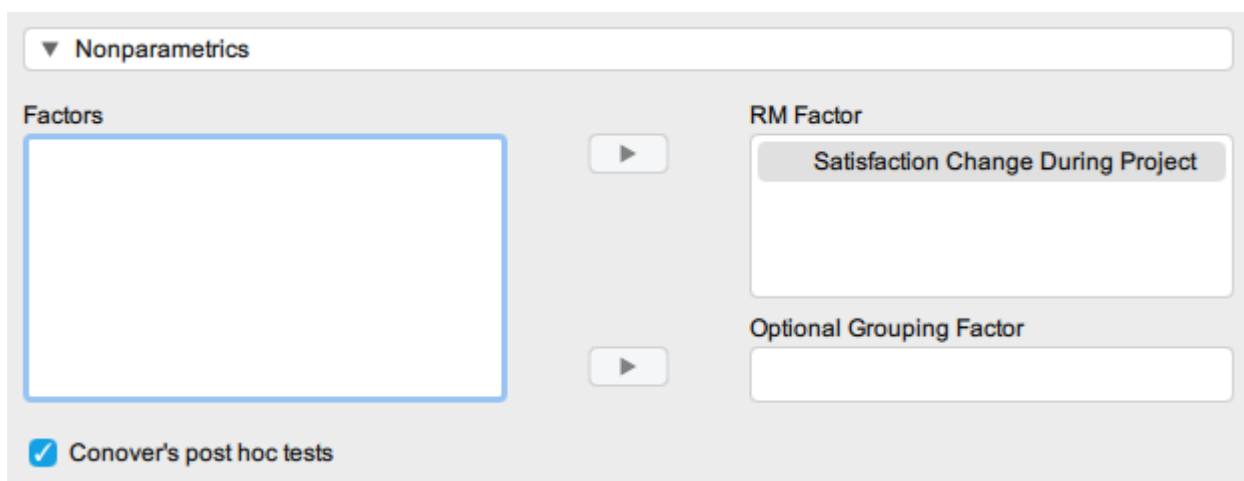


A vertical list of options, each with a right-pointing arrow icon and a text label. The options are: Model, Assumption Checks, Contrasts, Order Restricted Hypotheses, Post Hoc Tests, Descriptives Plots, Bar Plots, Raincloud Plots, Marginal Means, Simple Main Effects, and Nonparametrics. The 'Nonparametrics' option is highlighted with a darker background.

Move factor and choose Conover's post hoc test



The 'Nonparametrics' dialog box. It has a title bar with a dropdown arrow and the text 'Nonparametrics'. Below the title bar, there are two main sections: 'Factors' and 'RM Factor'. The 'Factors' section contains a list box with 'Satisfaction Change During Project' selected. To the right of the list box are two buttons: a left-pointing arrow and a right-pointing arrow. The 'RM Factor' section contains a text box. Below the 'RM Factor' section is an 'Optional Grouping Factor' section with a text box. At the bottom, there is a checkbox labeled 'Conover's post hoc tests' which is checked.



The 'Nonparametrics' dialog box. It has a title bar with a dropdown arrow and the text 'Nonparametrics'. Below the title bar, there are two main sections: 'Factors' and 'RM Factor'. The 'Factors' section contains an empty list box. To the right of the list box are two buttons: a left-pointing arrow and a right-pointing arrow. The 'RM Factor' section contains a text box with 'Satisfaction Change During Project' entered. Below the 'RM Factor' section is an 'Optional Grouping Factor' section with a text box. At the bottom, there is a checkbox labeled 'Conover's post hoc tests' which is checked.

Choose Friedman Test.

Nonparametrics

Friedman Test

Factor	X^2_F	df	p	Kendall's W
Satisfaction Change During Project	33.63	3	< .001	0.160

Conover Test

Conover's Post Hoc Comparisons - Satisfaction Change During Project

		T-Stat	df	W_i	W_j	r_{rb}	p	p_{bonf}
Time 1	Time 2	2.953	207	131.5	169.5	-0.540	.004	.021
	Time 3	4.624	207	131.5	191.0	-0.801	< .001	< .001
	Time 4	5.945	207	131.5	208.0	-0.749	< .001	< .001
Time 2	Time 3	1.671	207	169.5	191.0	-0.295	.096	.578
	Time 4	2.992	207	169.5	208.0	-0.396	.003	.019
Time 3	Time 4	1.321	207	191.0	208.0	-0.302	.188	1.000

Note. Grouped by subject.

Note. Rank-biserial correlation based on individual signed-rank tests.

Yes, there is a statistically significant difference ($p < 0.001$) overall between the job satisfaction scores at different times during the project.

Post Hoc Test – Some differences

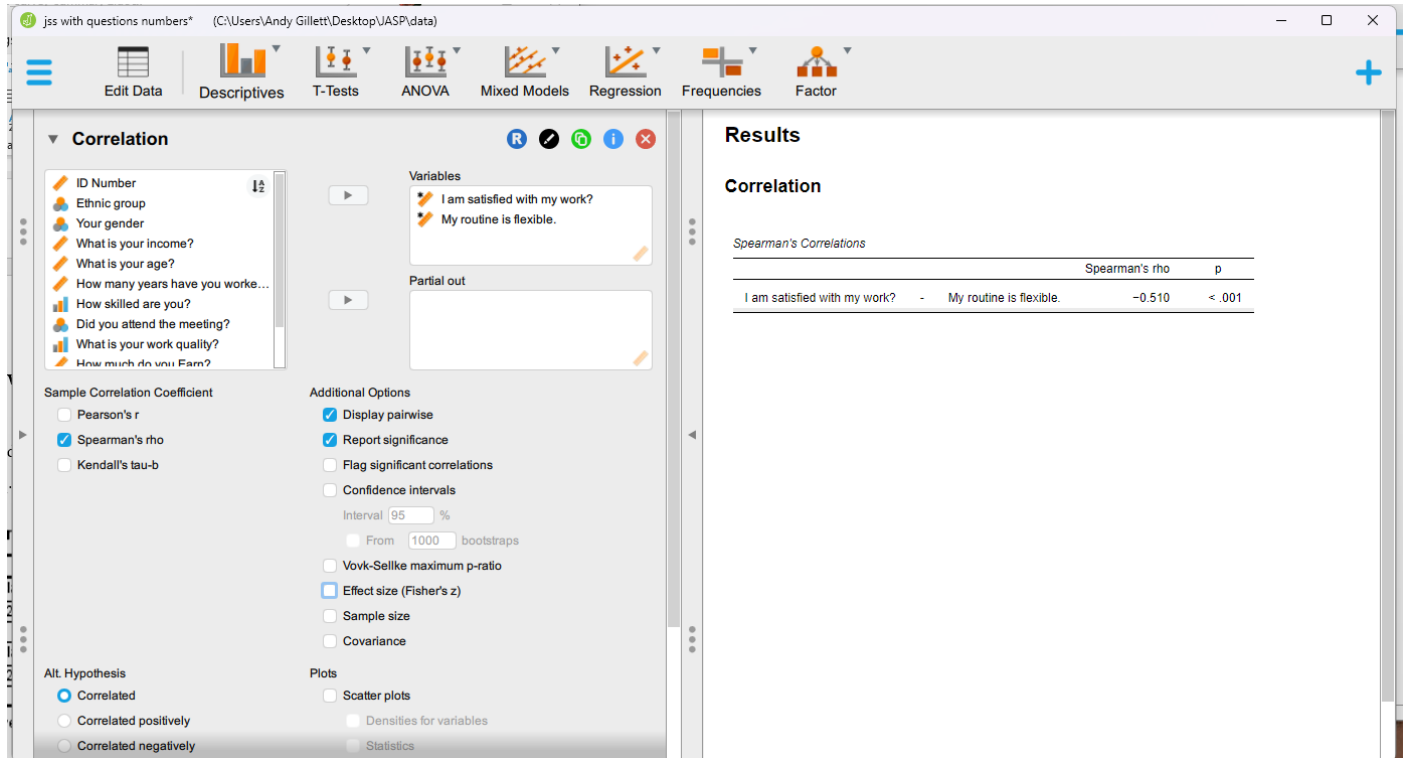
Pairwise comparisons show significant differences between Time 1 & Time 2, Time 1 & Time 3, Time 1 & Time 4, and Time 2 & Time 4 but not between Time 2 & Time 3 and Time 3 & Time 4.

9. What about the Relationship between Variables Measured on a Likert Scale?

[Analyses -> Regression -> Correlation]

Choose Spearman, not Pearson, for ranked data

For example, is there a relationship between Job Satisfaction and Autonomy.



The screenshot shows the JASP software interface for a Correlation analysis. The 'Variables' list on the left includes 'I am satisfied with my work?' and 'My routine is flexible.'. The 'Sample Correlation Coefficient' section has 'Spearman's rho' selected. The 'Additional Options' section has 'Display pairwise', 'Report significance', and 'Effect size (Fisher's z)' checked. The 'Results' panel on the right shows the Spearman's rho correlation matrix.

		Spearman's rho	p	
I am satisfied with my work?	-	My routine is flexible.	-0.510	< .001

There is a significant relationship between autonomy and job satisfaction (< 0.001) & a strong correlation (0.510).

10. Summarising Likert Scale Results

jss-edited-satisfaction-4-numbers (D:\AJG\Documents\AJG Documents\VASP\data\Used)

	id	ethnicgp	gender	income	age	attend	years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4	
1	1	1	1	8300	29	2	1	3	2	4	2	2	
2	2	2	1	7300	26	1	5	3	2	2	3	3	
3	3	3	1	8900	40	1	5	4	2	4	5	2	
4	4	3	1	8200	46	2	15	3	2	2	2	3	
5	5	2	2	9300	63	1	36	3	3	4	5	4	
6	6	1	1	8000	54	1	31	1	2	2	3	4	
7	7	1	1	8300	29	2	2	3	2	2	3	3	
8	8	3	1	8800	35	2	2	3	2	5	4	3	
9	9	2	2	8800	33	2	4	2	1	3	2	2	
10	10	2	2	6900	27	1	6	2	2	4	3	3	
11	11	1	1	7100	29	2	4	2	2	2	2	5	
12	12	2	1	0	19	1	2	3	1	1	4	3	
13	13	4	1	9000	55	1	35	4	2	3	4	5	
14	14	1	2	8500	29	1	1	1	1	2	2	4	
15	15	3	1	9100	48	2	8	4	4	3	5	2	
16	16	2	1	7900	32	2	7	2	2	3	4	4	
17	17	1	1	8300	48	1	14	2	2	3	4	4	
18	18	1	2	6700	18	1	1	2	2	2	2	5	
19	19	3	2	7500	28	2	2	3	3	4	4	3	
20	20	3	2	8800	37	1	1	1	2	3	3	5	
21	21	1	1	0	43	2	16	4	3	1	3	3	
22	22	1	1	8700	39	2	6	1	3	3	3	4	
23	23	1	1	9000	53	1	5	3	2	1	2	3	

[Edit Data]

jss-edited-satisfaction-4-numbers (D:\AJG\Documents\AJG Documents\VASP\data\Used)

	id	ethnicgp	gender	income	age	attend	years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4	
1	1	1	1	8300	29	2	1	3	2	4	2	2	
2	2	2	1	7300	26	1	5	3	2	2	3	3	
3	3	3	1	8900	40	1	5	4	2	4	5	2	
4	4	3	1	8200	46	2	15	3	2	2	2	3	
5	5	2	2	9300	63	1	36	3	3	4	5	4	
6	6	1	1	8000	54	1	31	1	2	2	3	4	
7	7	1	1	8300	29	2	2	3	2	2	3	3	
8	8	3	1	8800	35	2	2	3	2	5	4	3	
9	9	2	2	8800	33	2	4	2	1	3	2	2	
10	10	2	2	6900	27	1	6	2	2	4	3	3	
11	11	1	1	7100	29	2	4	2	2	2	2	5	
12	12	2	1	0	19	1	2	3	1	1	4	3	
13	13	4	1	9000	55	1	35	4	2	3	4	5	
14	14	1	2	8500	29	1	1	1	1	2	2	4	
15	15	3	1	9100	48	2	8	4	4	3	5	2	
16	16	2	1	7900	32	2	7	2	2	3	4	4	
17	17	1	1	8300	48	1	14	2	2	3	4	4	
18	18	1	2	6700	18	1	1	2	2	2	2	5	
19	19	3	2	7500	28	2	2	3	3	4	4	3	

Name:
Long name:

Column type:
Scale
Description:
...

Computed type:
Not computed

Missing values
☐ Use custom values

+

Reset

Show workspace missing values

Name:
Total Satisfaction
Long name:
Total Satisfaction

Column type:
Ordinal
Description:
...

Computed type:
Computed with drag-and-drop

id

ethnlogp

gender

income

age

attend

years

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rowMedian(
satisfaction1 ,
satisfaction2 ,
satisfaction3 ,
satisfaction4 ,
...
)

median(y)

rowMean(...)

rowΣ...

rowσ...

rowVariance(...)

rowMedian(...)

rowMin(...)

rowMax(...)

Compute column

No filter

jss-edited-satisfaction-4-numbers* (D:\AJG\Documents\AJG Documents\JASP\data\Used)

Analyses

Synchronisation

Resize Data

Insert

Remove

Undo

Redo

	id	ethnlogp	gender	income	age	attend	years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4	Total Satisfaction	f _x
1	1	1	1	8300	29	2	1	3	2	4	2	2	2	
2	2	2	1	7300	26	1	5	3	2	2	3	3	2.5	
3	3	3	1	8900	40	1	5	4	2	4	5	2	3	
4	4	3	1	8200	46	2	15	3	2	2	2	3	2	
5	5	2	2	9300	63	1	36	3	3	4	5	4	4	
6	6	1	1	8000	54	1	31	1	2	2	3	4	2.5	
7	7	1	1	8300	29	2	2	3	2	2	3	3	2.5	
8	8	3	1	8800	35	2	2	3	2	5	4	3	3.5	
9	9	2	2	8800	33	2	4	2	1	3	2	2	2	
10	10	2	2	6900	27	1	6	2	2	4	3	3	3	
11	11	1	1	7100	29	2	4	2	2	2	2	5	2	
12	12	2	1	0	19	1	2	3	1	1	4	3	2	
13	13	4	1	9000	55	1	35	4	2	3	4	5	3.5	
14	14	1	2	8500	29	1	1	1	1	2	2	4	2	
15	15	3	1	9100	48	2	8	4	4	3	5	2	3.5	
16	16	2	1	7900	32	2	7	2	2	3	4	4	3.5	
17	17	1	1	8300	48	1	14	2	2	3	4	4	3.5	
18	18	1	2	6700	18	1	1	2	2	2	2	5	2	
19	19	3	2	7500	28	2	2	3	3	4	4	3	3.5	
20	20	3	2	8800	37	1	1	1	2	3	3	5	3	
21	21	1	1	0	43	2	16	4	3	1	3	3	3	
22	22	1	1	8700	39	2	6	1	3	3	3	4	3	
23	23	1	1	9000	53	1	5	3	2	1	2	3	2	

11. References and Further Reading

- Brown, J. D. & Rogers, T. S. (2002). *Doing second language research*. Oxford: Oxford University Press.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York: Routledge
- Dörnyei, Z. (2007). *Research methods in applied linguistics*. Oxford: Oxford University Press.
- De Winter, J. C. F. & Dodou, D. (2012). Five point Likert items: T-test versus Mann-Whitney-Wilcoxon. *Practical Assessment, Research and Evaluation*, 15(11).
- Field, A., van Doorn, J. & Wagenmakers, E.-J. (2025). *Discovering statistics using JASP*. London: Sage.
- Hand, D. J. (2008) *Statistics: A very short introduction*. Oxford: Oxford University Press.
- Halter, C. P. (2024). *Quantitative Analysis with JASP open-source software: Foundational Methods*. Author
- Hatch, E. & Lazaraton, A. (1991). *The research manual: Design and statistics for applied linguistics*. Boston, MA: Heinle & Heinle.
- Lowie, W. & Seton, B. (2013). *Essential statistics for applied linguistics*. London: Palgrave Macmillan.
- Navarro, D.J., Foxcroft, D.R., & Faulkenberry, T.J. (2025). *Learning Statistics with JASP: A Tutorial for Psychology Students and Other Beginners*. (Version 2.0).
<https://learnstatswithjasp.com>
- Popham, W. J. & Sirotnik, K. A. (1973). *Educational statistics: Use and interpretation* (2nd ed.). New York: Harper & Row
- Salkind, N. J. (2011). *Statistics for people who (think they) hate statistics* (4th ed.). London: Sage.
- Saunders, M. & Lewis, P. (2012). *Doing research in business and management*. London: FT/Prentice Hall.
- Saunders, M., Lewis, P. & Thornhill, A. (2016). *Research methods for business students* (7th ed.). London: FT/Prentice Hall.
- Shavelson, R. (1988). *Statistical reasoning for the behavioral sciences*. Boston: Allyn and Bacon.
- Speigelhalter, D. (2020). *The art of statistics: Learning from data*. London: Pelican.