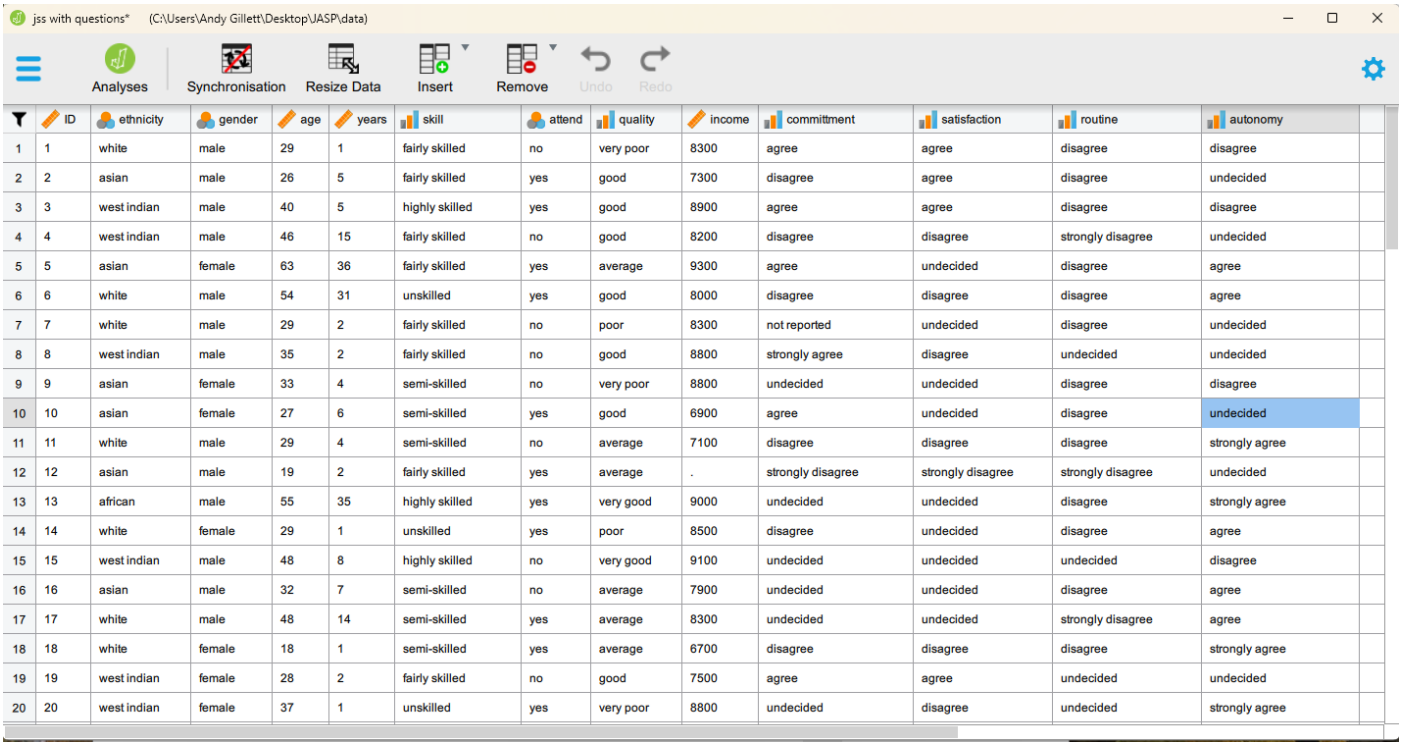
Statistical Analysis of Survey Data in JASP: 2 – Likert Scales

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)

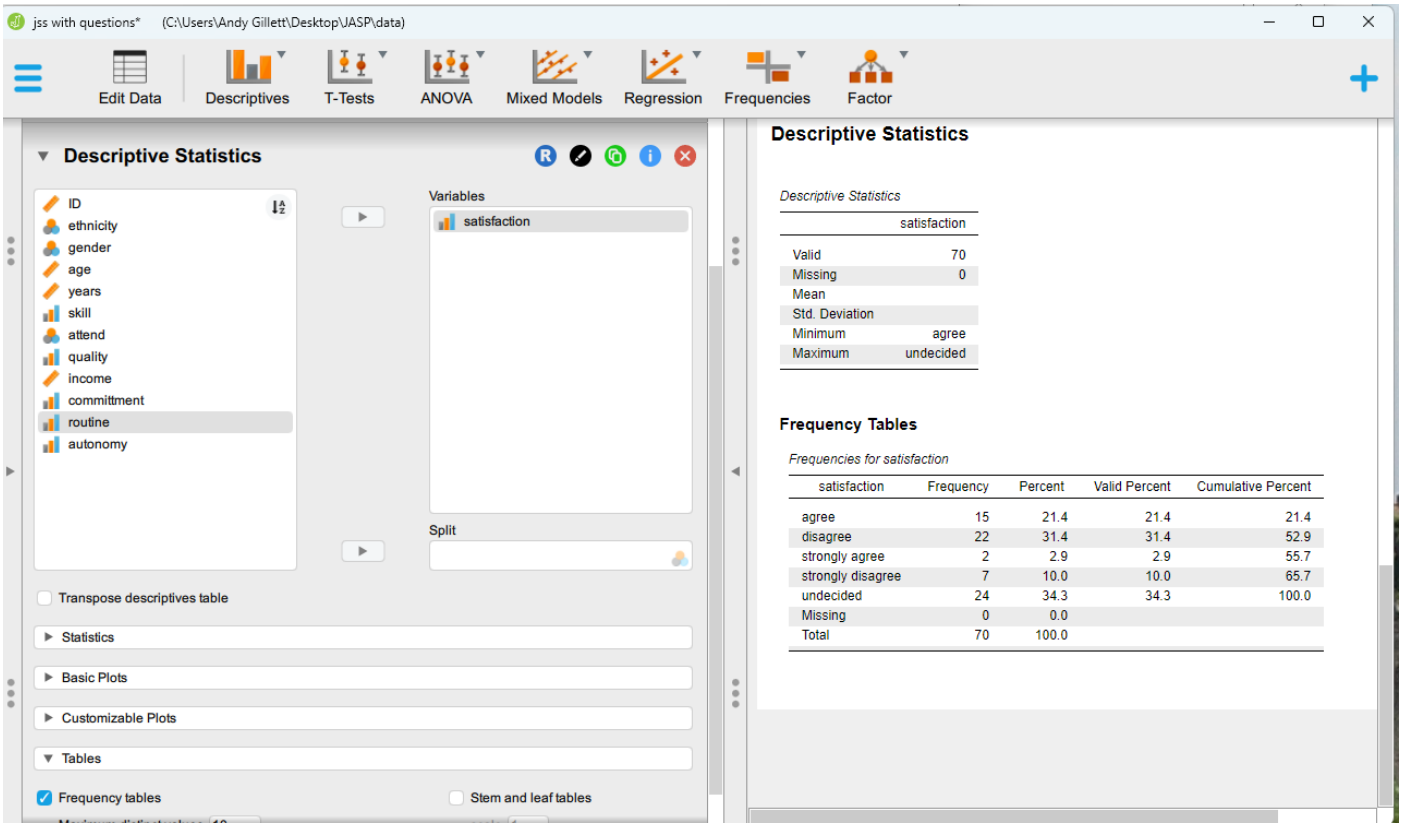


	ID	ethnicity	gender	age	years	skill	attend	quality	income	committment	satisfaction	routine	autonomy
1	1	white	male	29	1	fairly skilled	no	very poor	8300	agree	agree	disagree	disagree
2	2	asian	male	26	5	fairly skilled	yes	good	7300	disagree	agree	disagree	undecided
3	3	west indian	male	40	5	highly skilled	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]



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

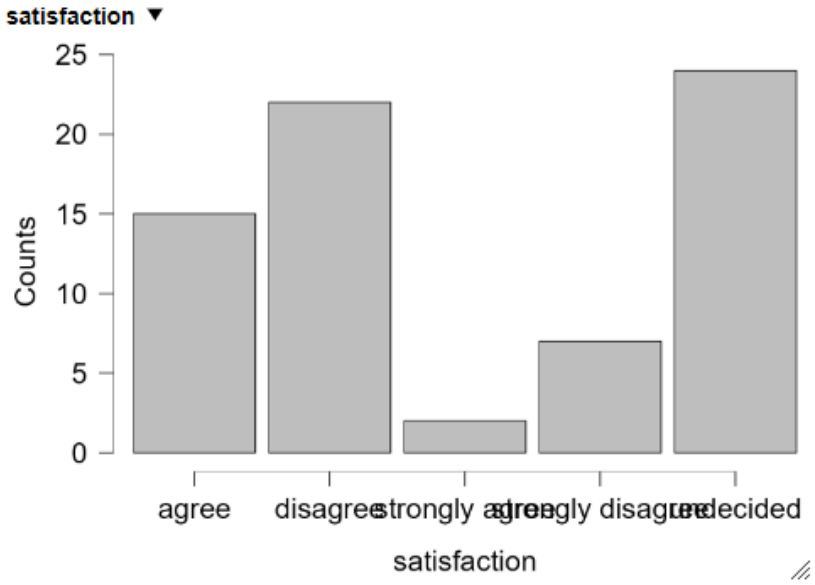
Frequency Tables ▼

Frequencies for satisfaction

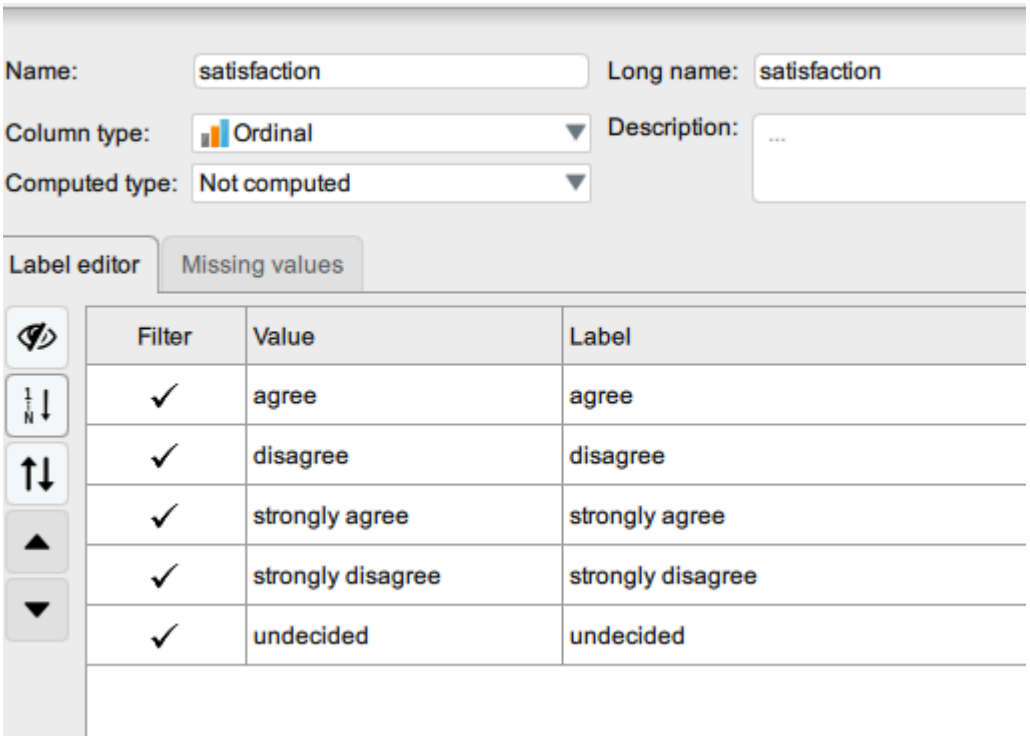
gender	satisfaction	Frequency	Percent	Valid Percent	Cumulative Percent
female	agree	7	22.6	22.6	22.6
	disagree	8	25.8	25.8	48.4
	strongly agree	0	0.0	0.0	48.4
	strongly disagree	4	12.9	12.9	61.3
	undecided	12	38.7	38.7	100.0
	Missing	0	0.0		
	Total	31	100.0		
male	agree	8	20.5	20.5	20.5
	disagree	14	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		

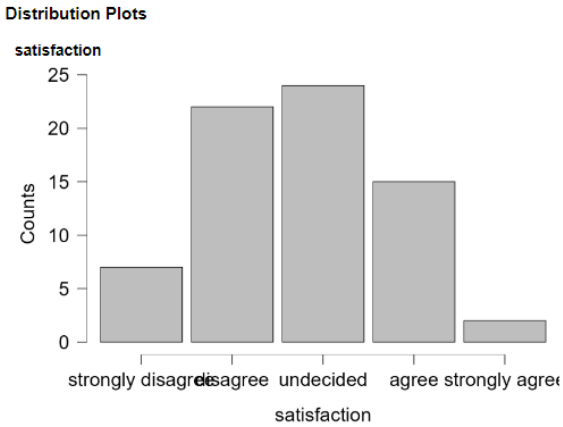
Or you could draw a Bar Graph

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

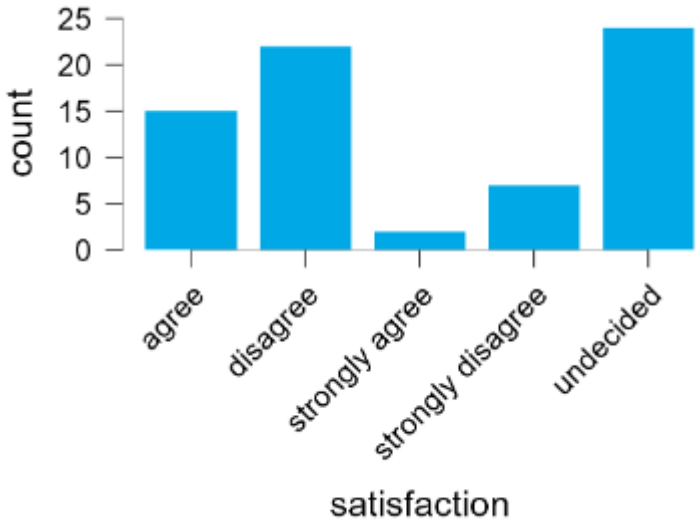


Change Order

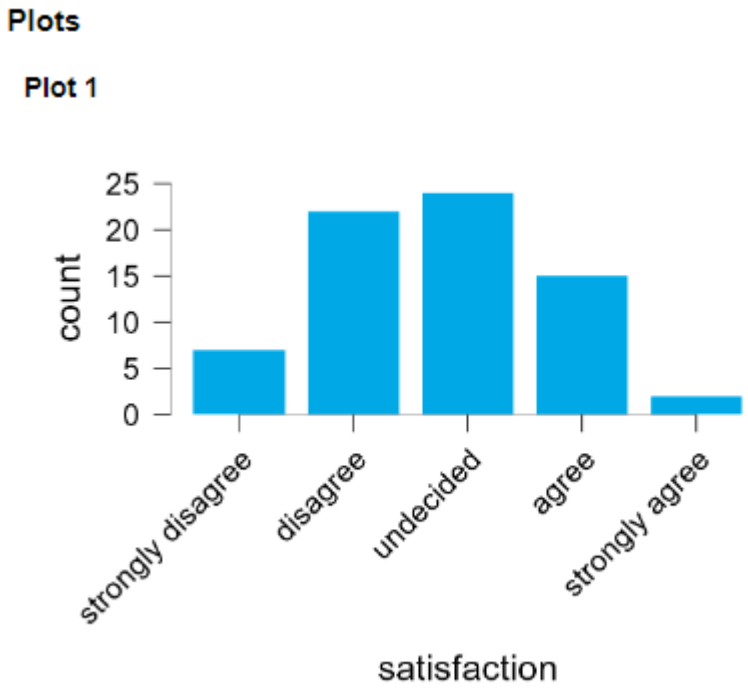




You can use Plot Builder to edit it more [Analyses -> Descriptives -> Plot Builder]



Or

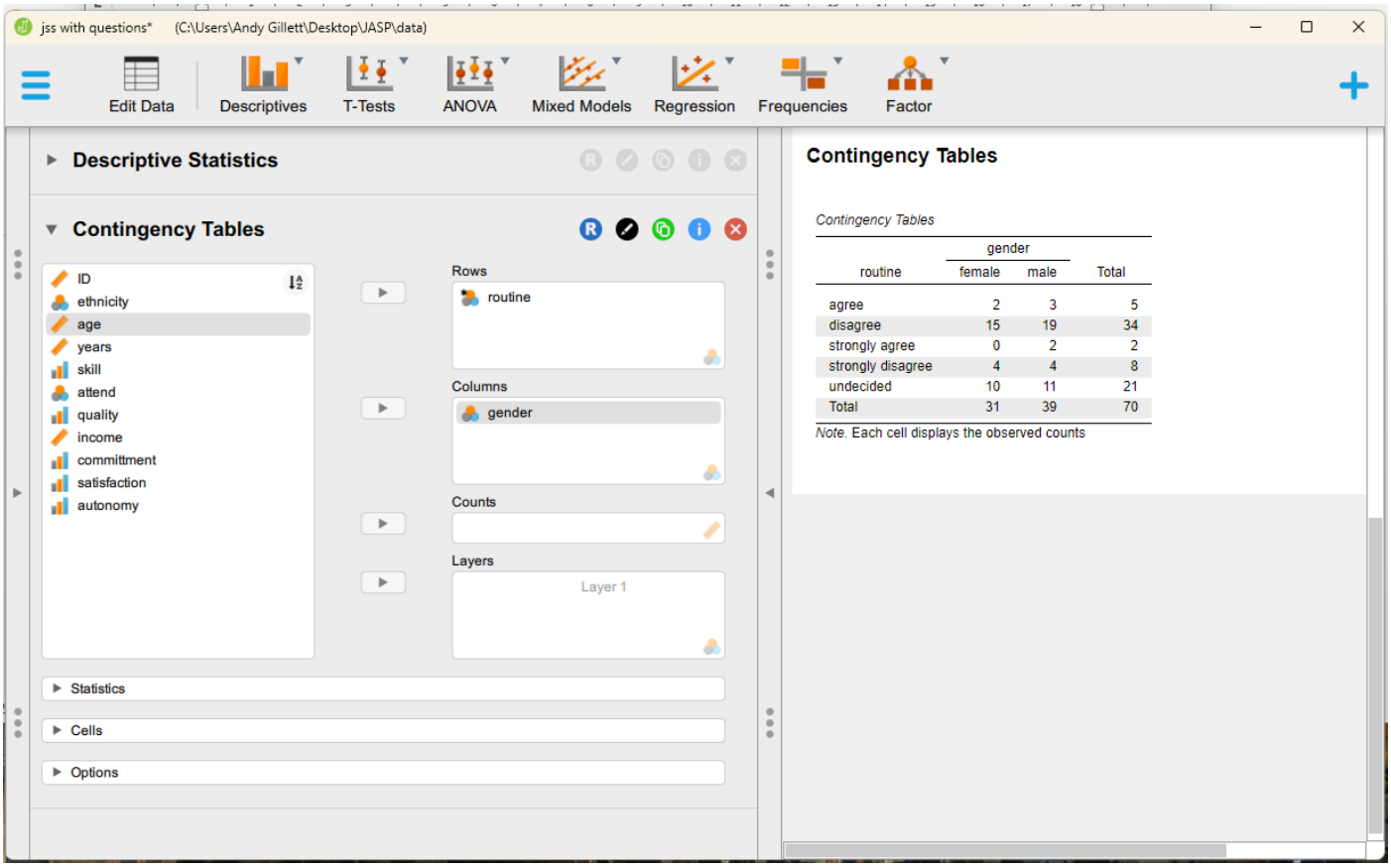


3. Tables

You can draw various tables from the data.

[Analyses -> Frequencies – Contingency Tables]

e.g. Satisfaction vs gender



Satisfaction vs ethnicity

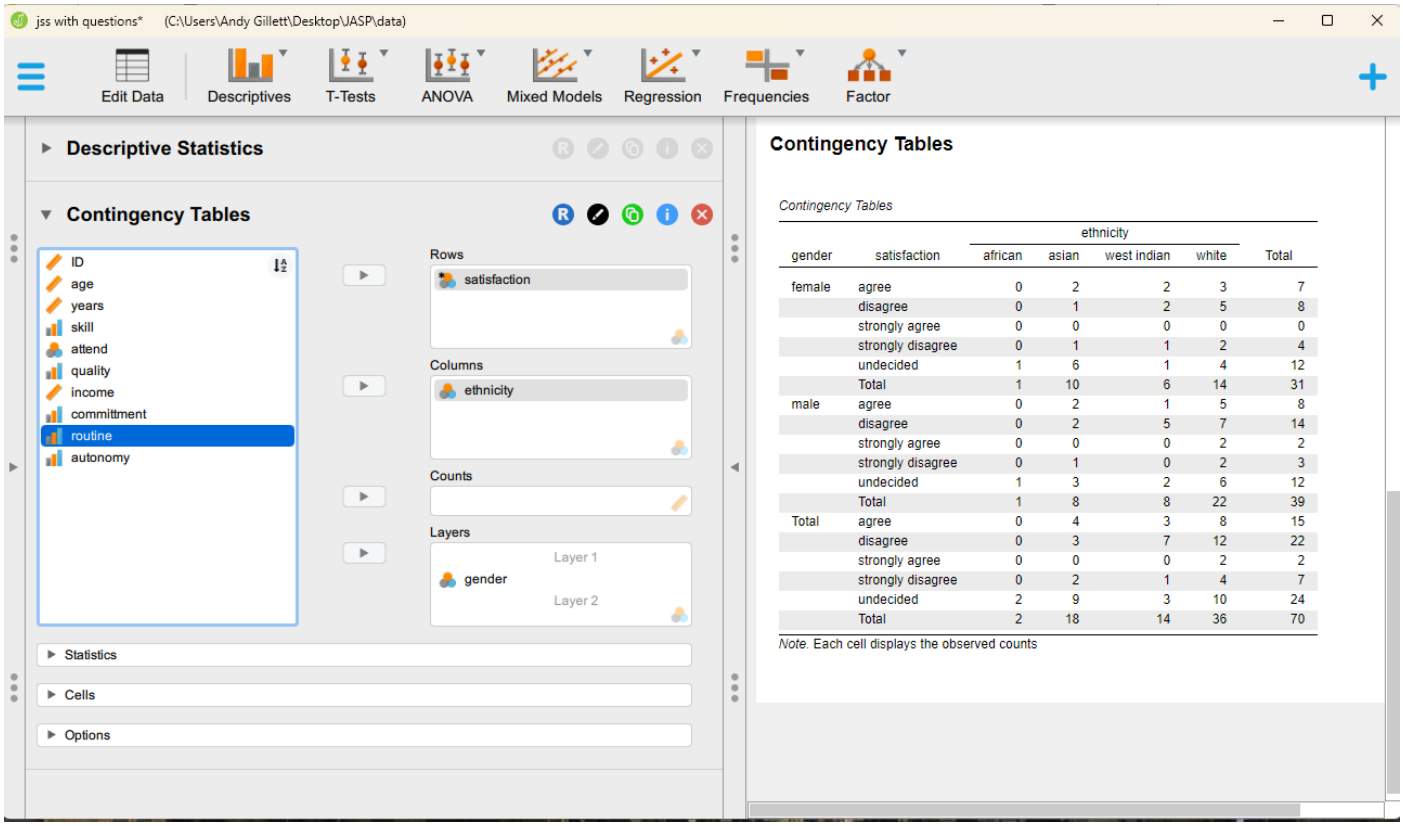
Contingency Tables

Contingency Tables

	ethnicity				
routine	african	asian	west indian	white	Total
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

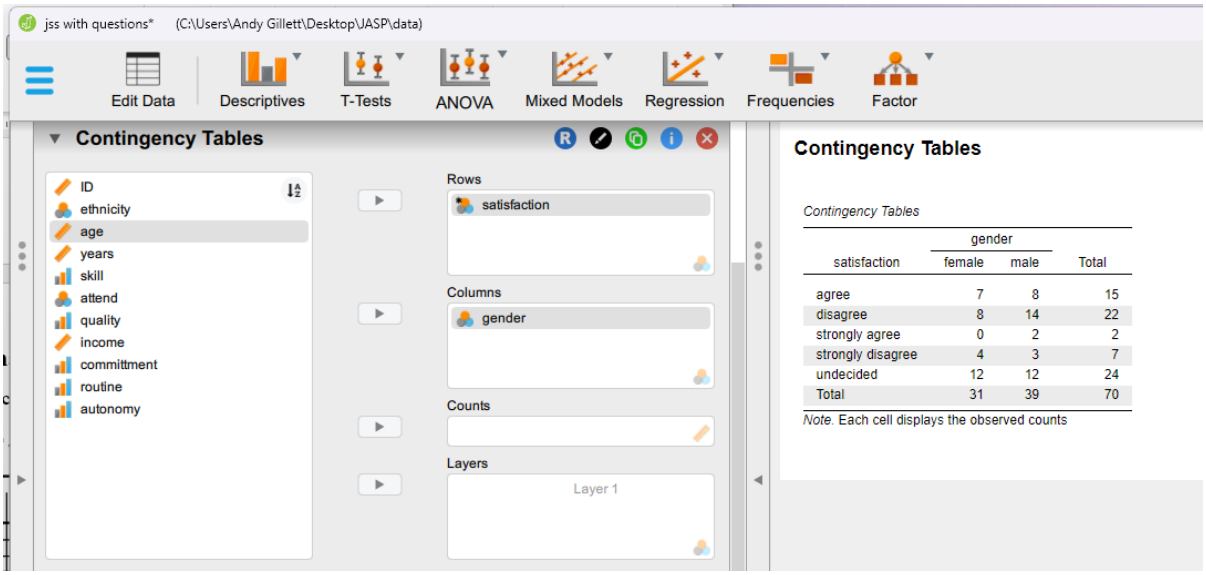
Note. Each cell displays the observed counts

Satisfaction vs gender & ethnicity

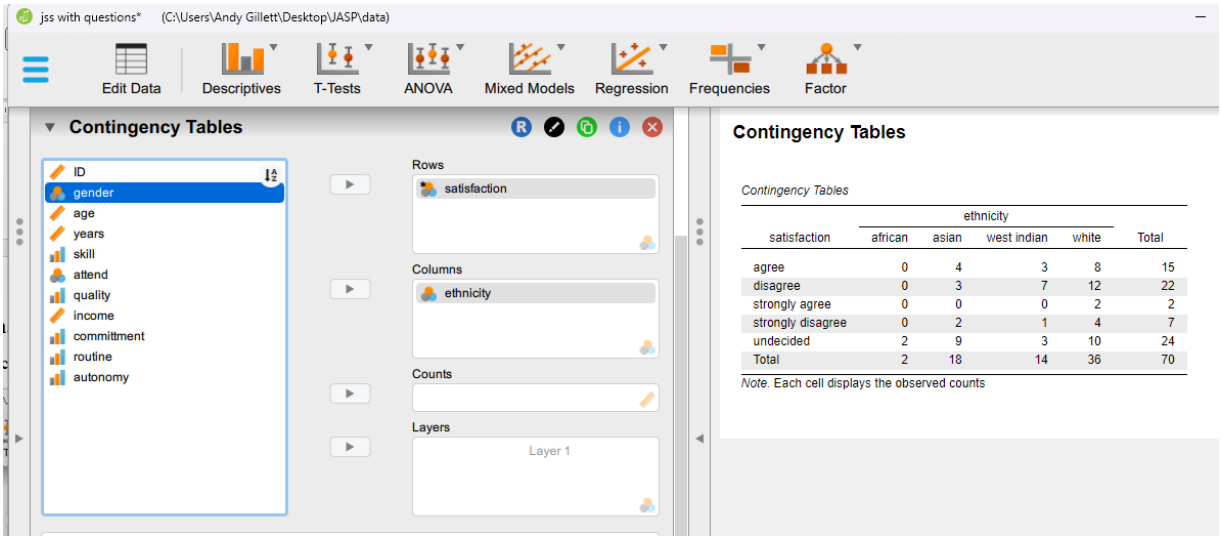


4. How do Males and Females Judge Job Satisfaction?

[Analyses -> Descriptive Statistics ->Contingency Tables]

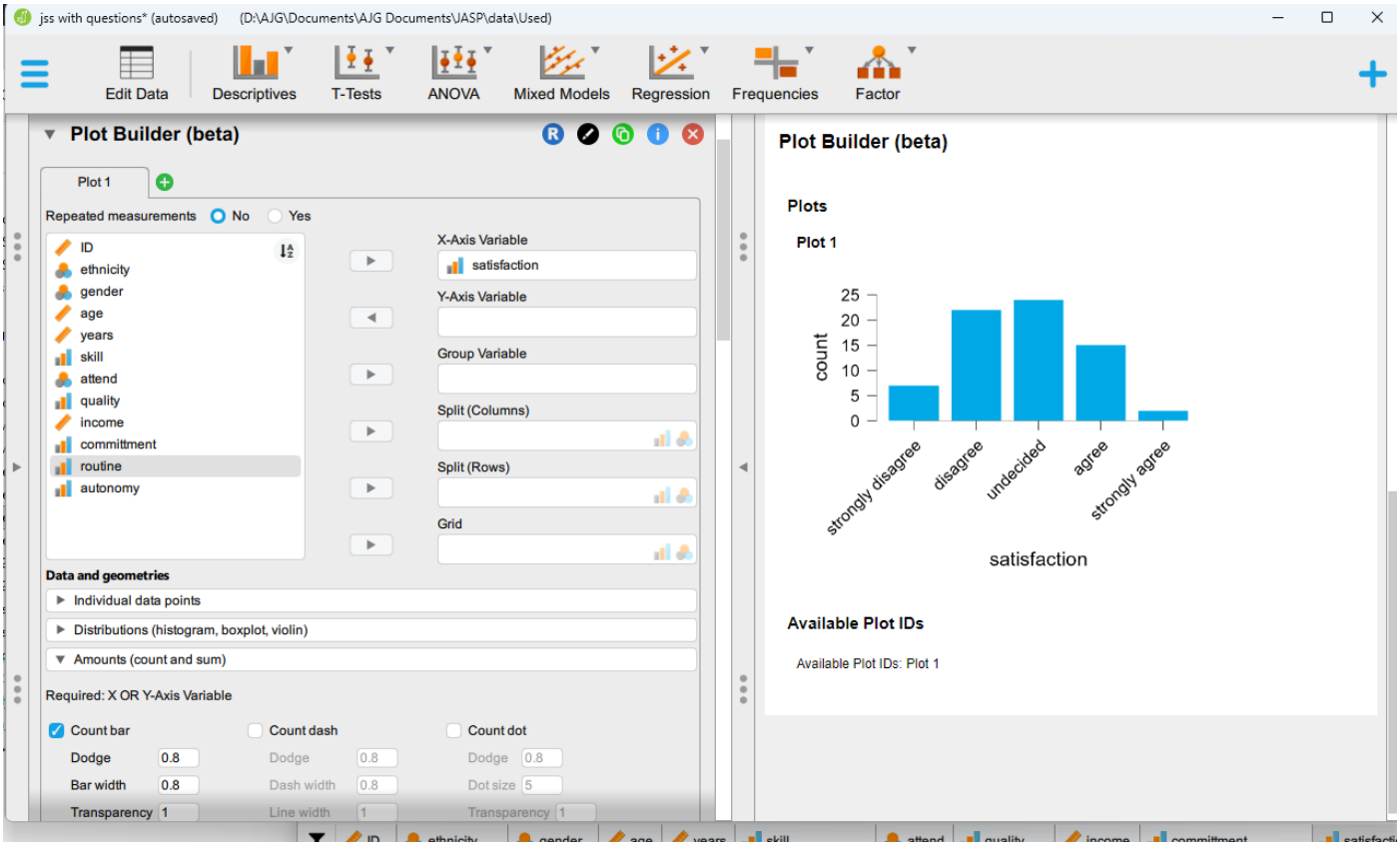


Or different ethnic groups?



We can diagram these.

Overall [Analyses -> Descriptives -> Plot Builder]


jss with questions* (autosaved)
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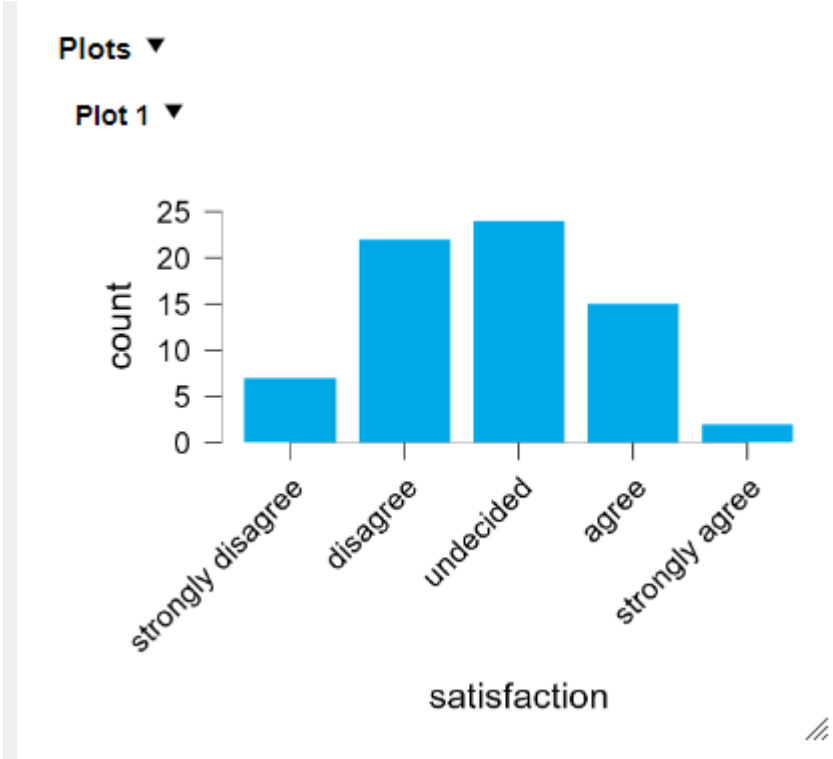
Edit Data
Descriptives
T-Tests
ANOVA
Mixed Models
Regression
Frequencies
Factor
Plot Builder (beta)
Plot 1
Repeated measurements
No
Yes
ID
ethnicity
gender
age
years
skill
attend
quality
income
committment
routine
autonomy
X-Axis Variable
satisfaction
Y-Axis Variable
Group Variable
Split (Columns)
Split (Rows)
Grid
Data and geometries
Individual data points
Distributions (histogram, boxplot, violin)
Amounts (count and sum)
Required: X OR Y-Axis Variable
Count bar
Count dash
Count dot
Dodge
Bar width
Dash width
Dot size
Transparency
Line width
Plot Builder (beta)
Plots
Plot 1
count
satisfaction
strongly disagree
disagree
undecided
agree
strongly agree
Available Plot IDs
Available Plot IDs: Plot 1


Plots
Plot 1
count
satisfaction
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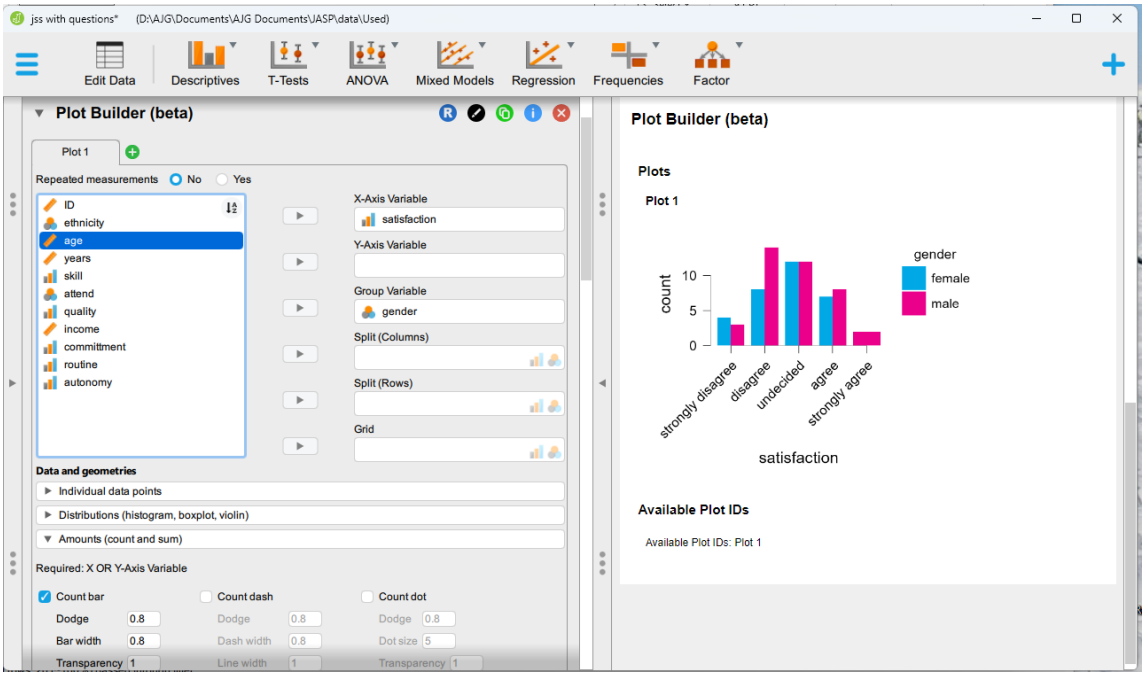
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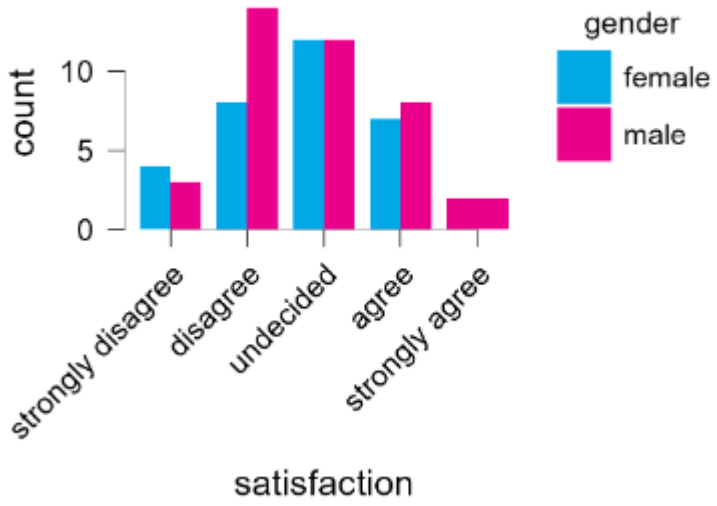
Dodge
Bar width
Transparency
Dash width
Line width
Dot size
Plot Builder (beta)
Plots
Plot 1
count
10
5
0
gender
female
male
strongly disagree
disagree
undecided
agree
strongly agree
satisfaction
Available Plot IDs
Available Plot IDs: Plot 1


count
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gender
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male
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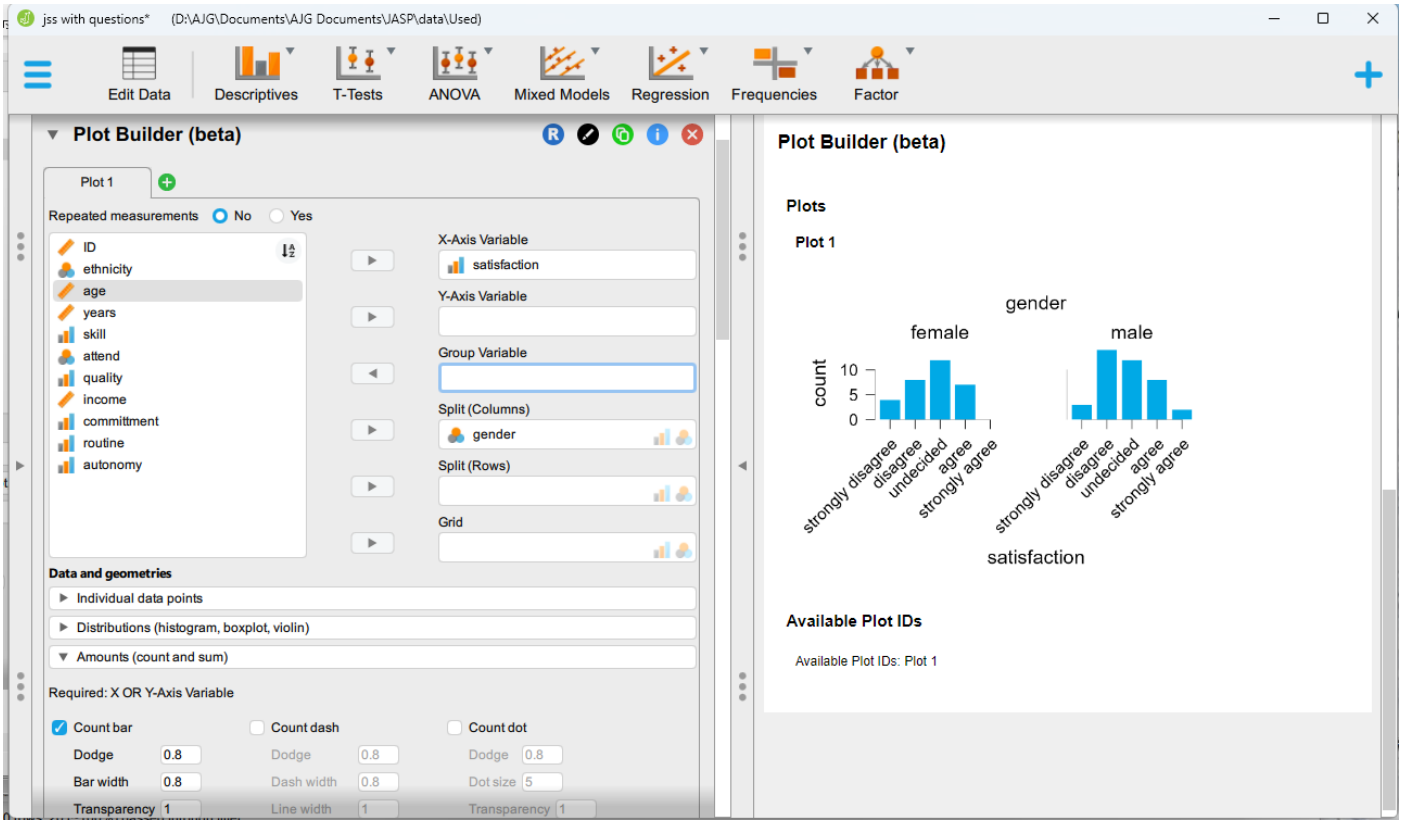
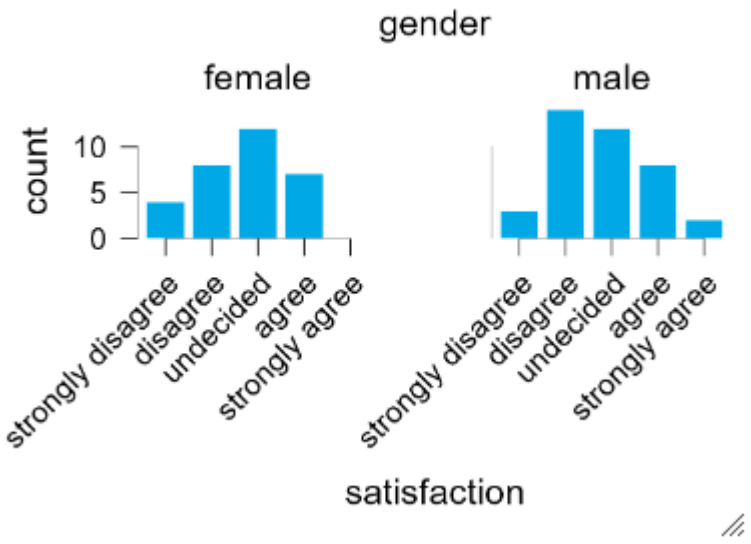
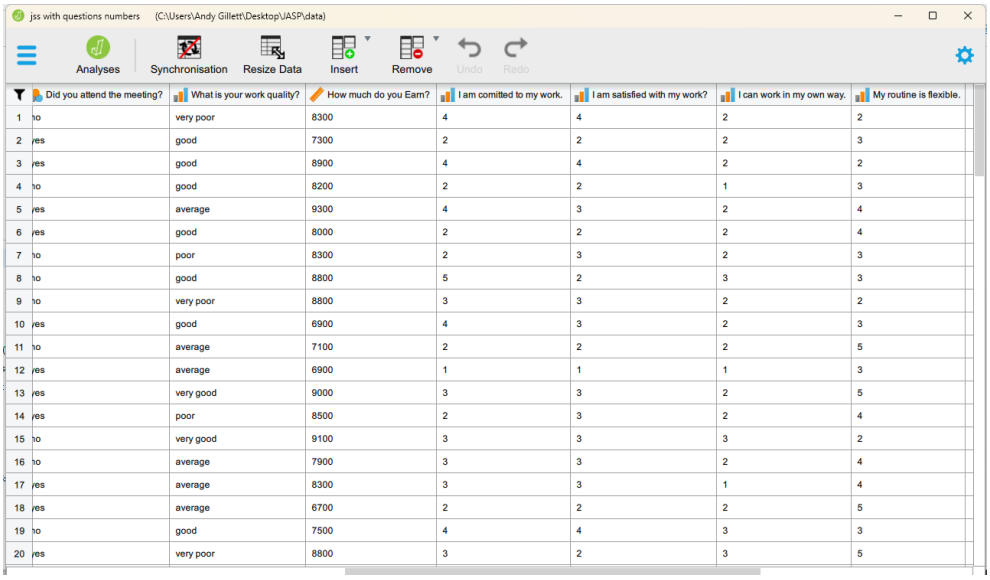
satisfaction





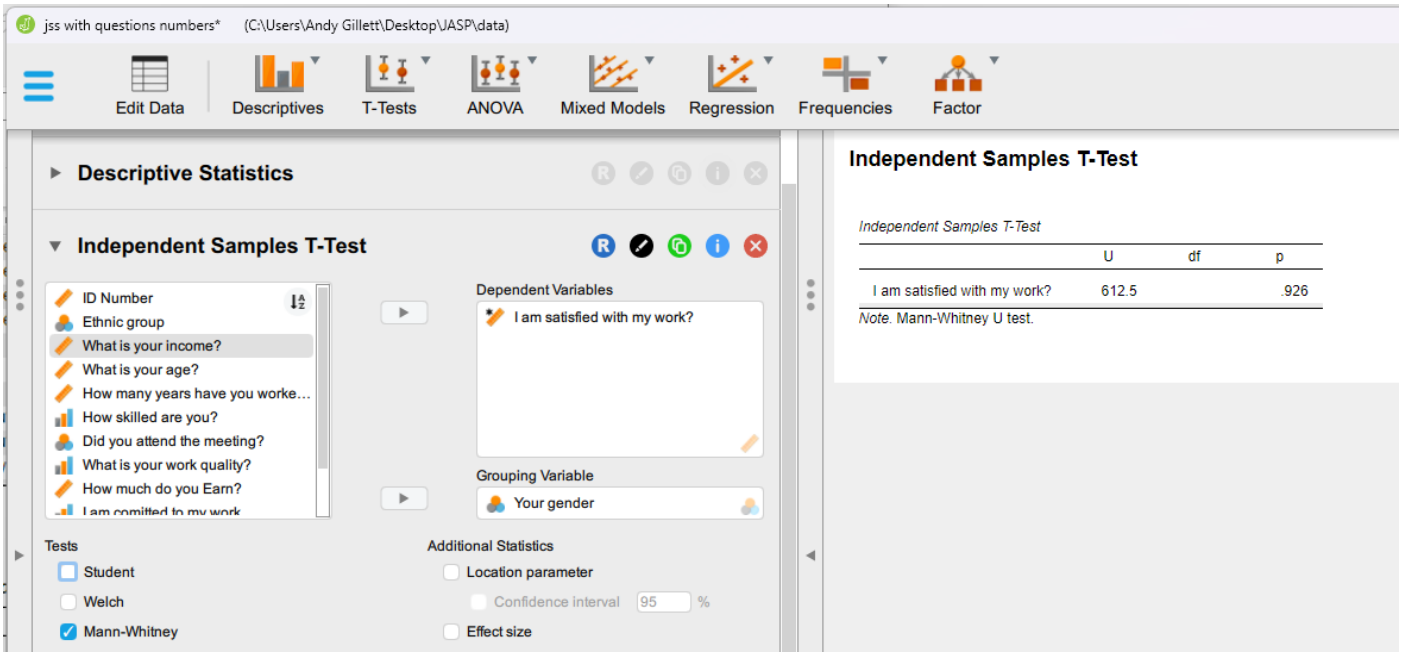
What about statistical; evidence for this. Are males and females different with regard to job satisfaction?

In this case we need numbers



	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	6900	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

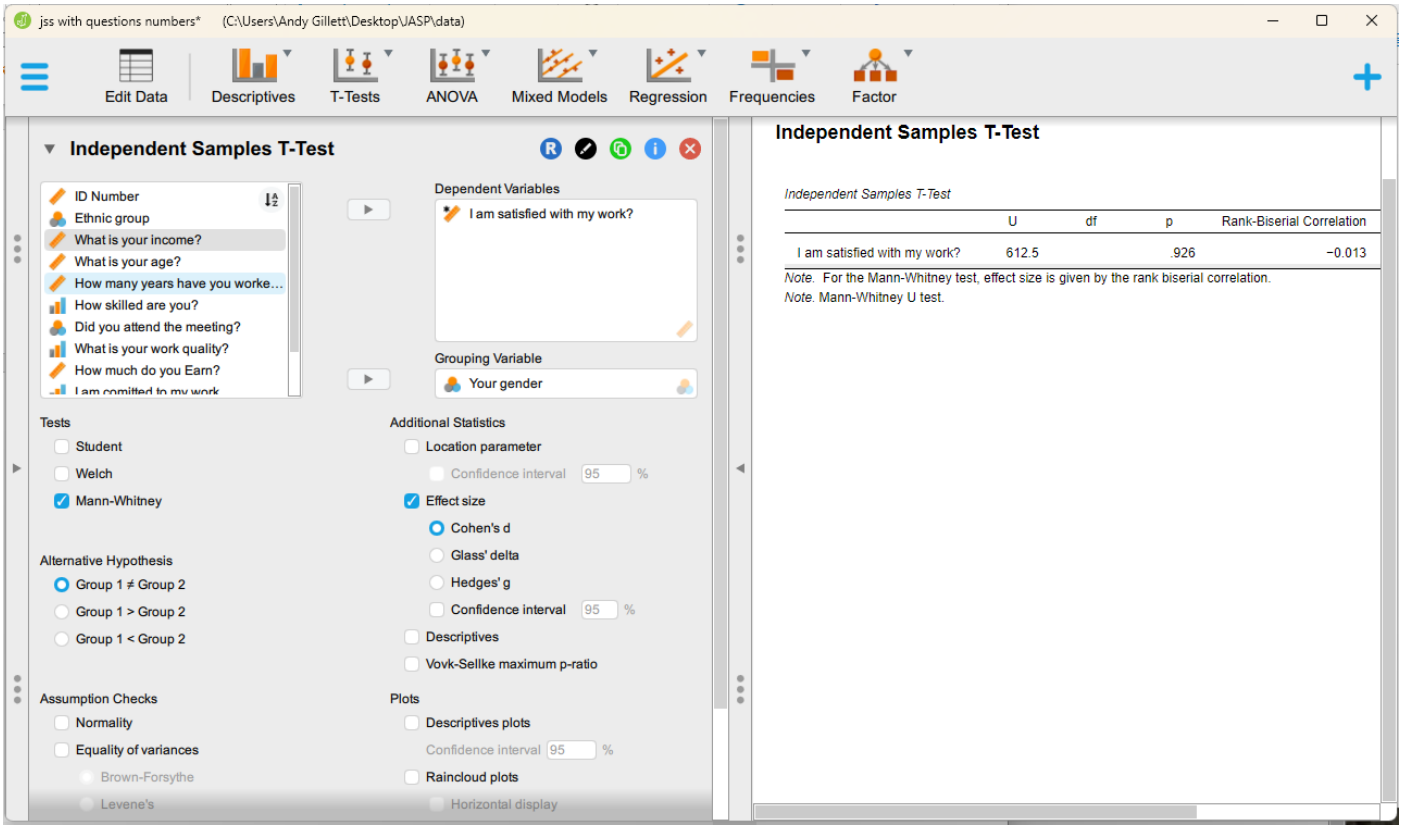
[Analysis -> T-Test -> Independent Samples T-Test]



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.

Efect Size – Very Low


jss with questions numbers* (C:\Users\Andy Gillett\Desktop\JASP\data)
Edit Data
Descriptives
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ANOVA
Mixed Models
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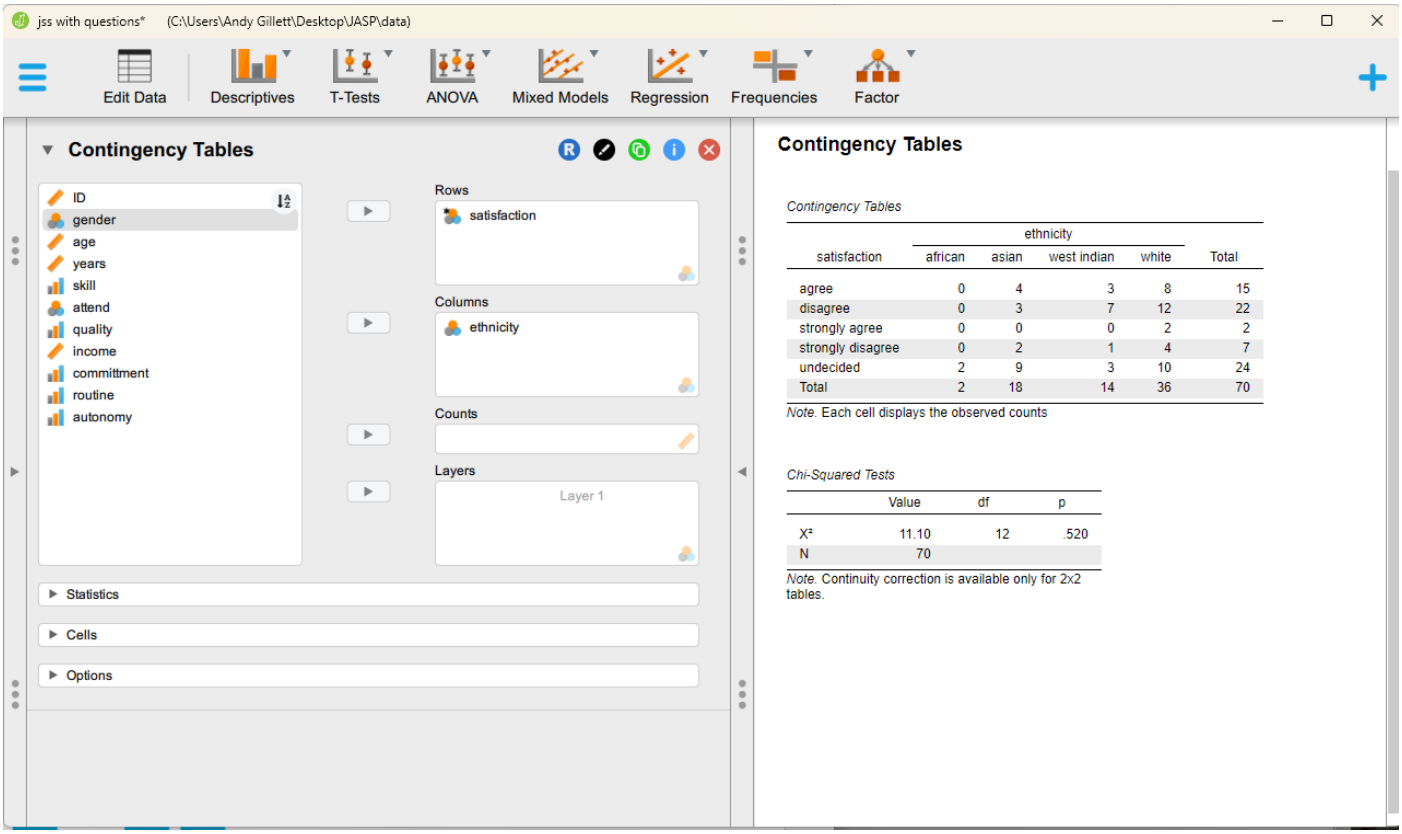
Frequencies
Factor
Independent Samples T-Test
ID Number
Ethnic group
What is your income?
What is your age?
How many years have you worke...
How skilled are you?
Did you attend the meeting?
What is your work quality?
How much do you Earn?
Dependent Variables
I am satisfied with my work?
Grouping Variable
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
Confidence interval 95 %
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.

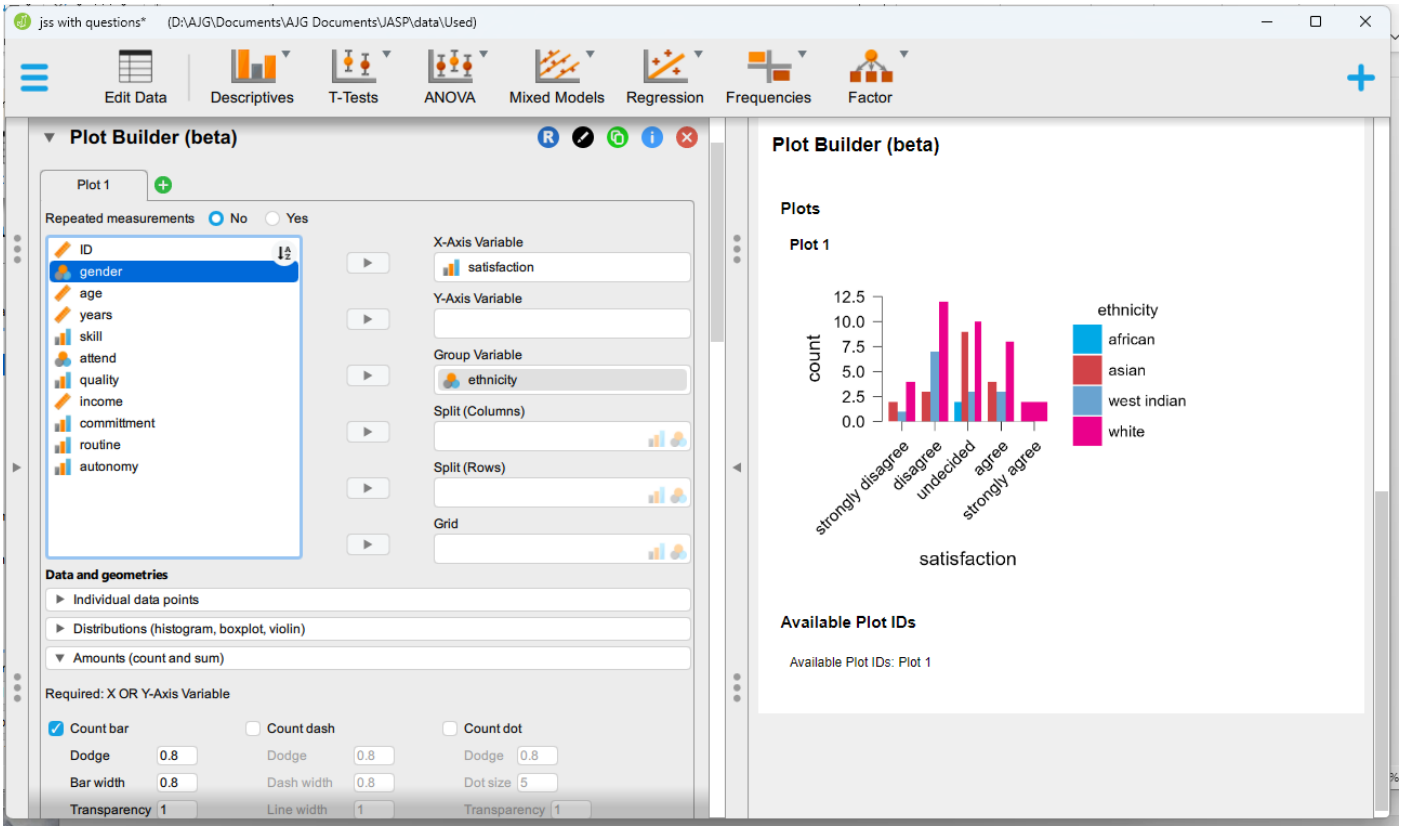
5. How do different Ethnicities Judge Job Satisfaction?

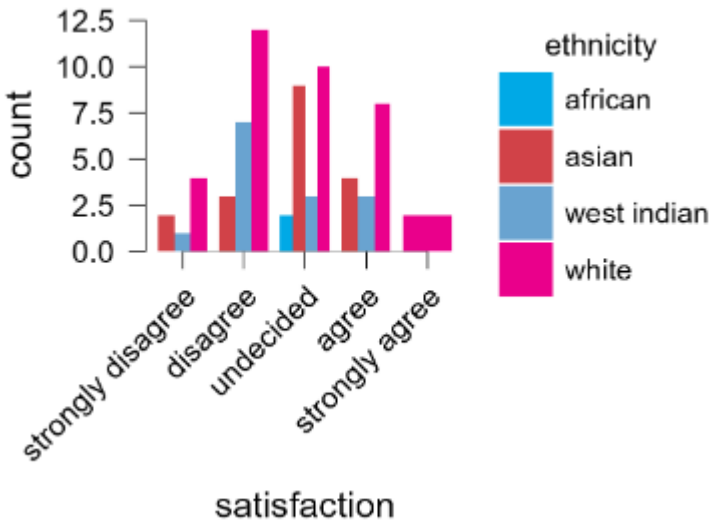
[Analyses -> Descriptive Statistics ->Contingency Tables]



We can diagram these.

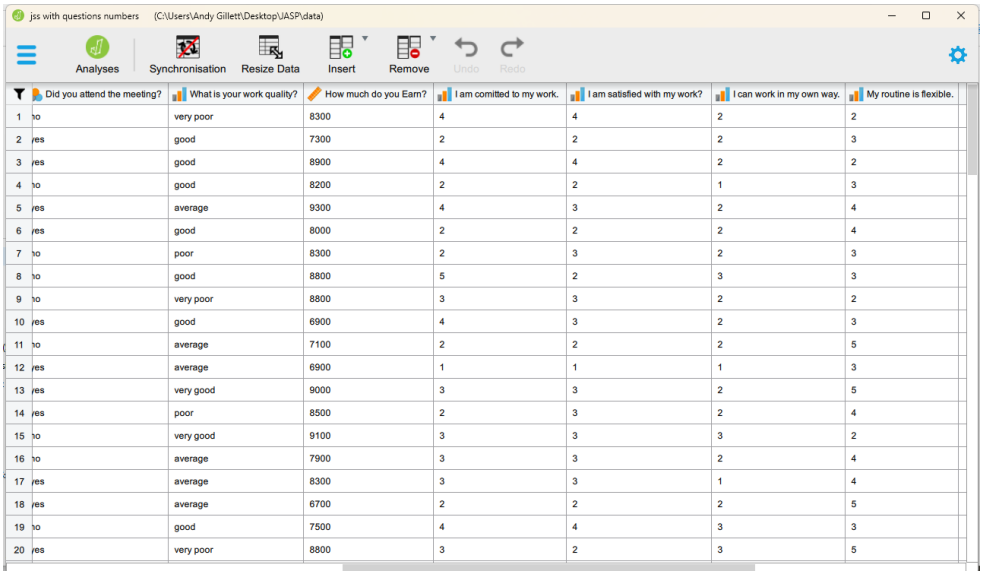
Overall **[**Analyse -> Descriptives -> Plot Builder**]**





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

Again we need numbers



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10	yes	good	6900	4	3	2	3
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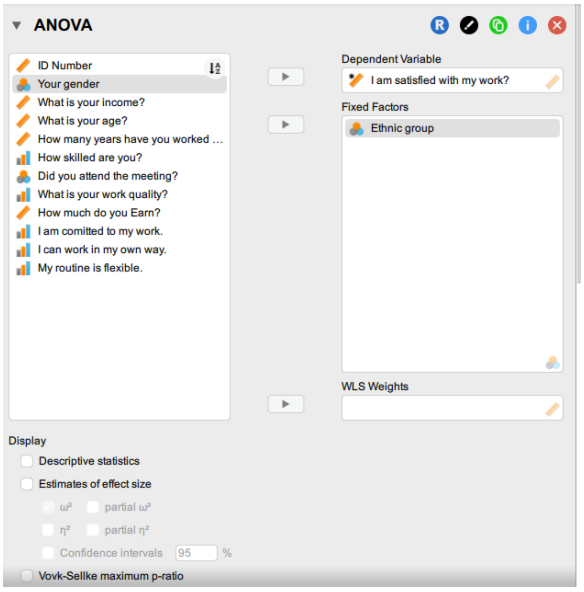
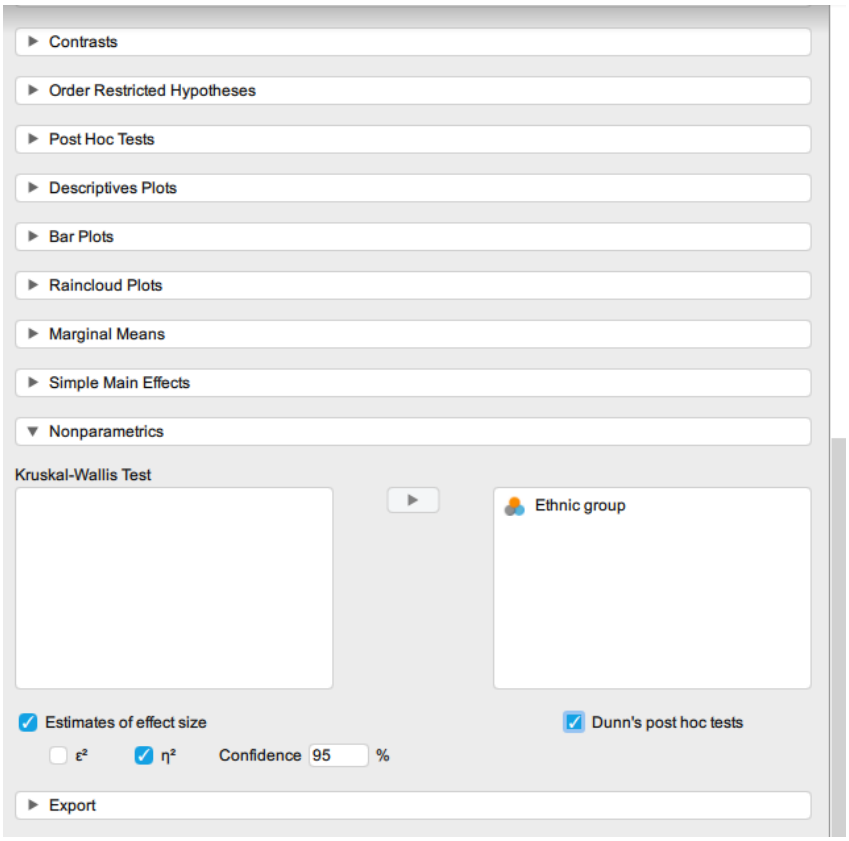
18	yes	average	6700	2	2	2	5
19	no	good	7500	4	4	3	3
20	yes	very poor	8800	3	2	3	5

[Analyses -> ANOVA -> ANOVA]



We need Nonparametric statistics for ordinal data



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

Kruskal-Wallis Test

Kruskal-Wallis Test

					95% CI for Rank η²	
Factor	Statistic	df	p	Rank η²	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

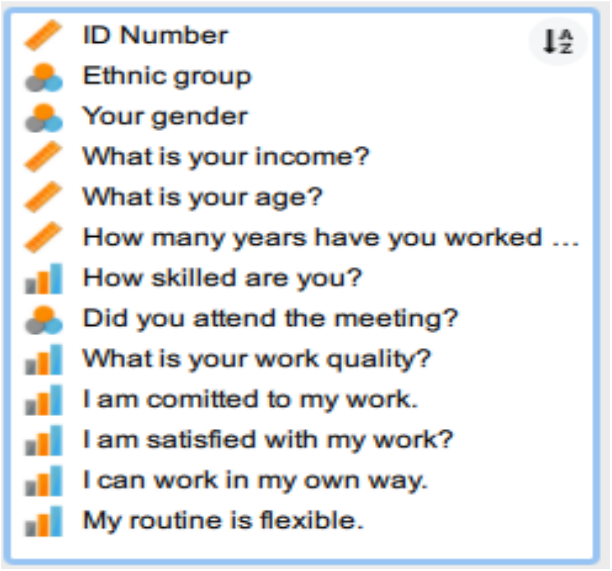
No significance so Post Hoc not useful

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

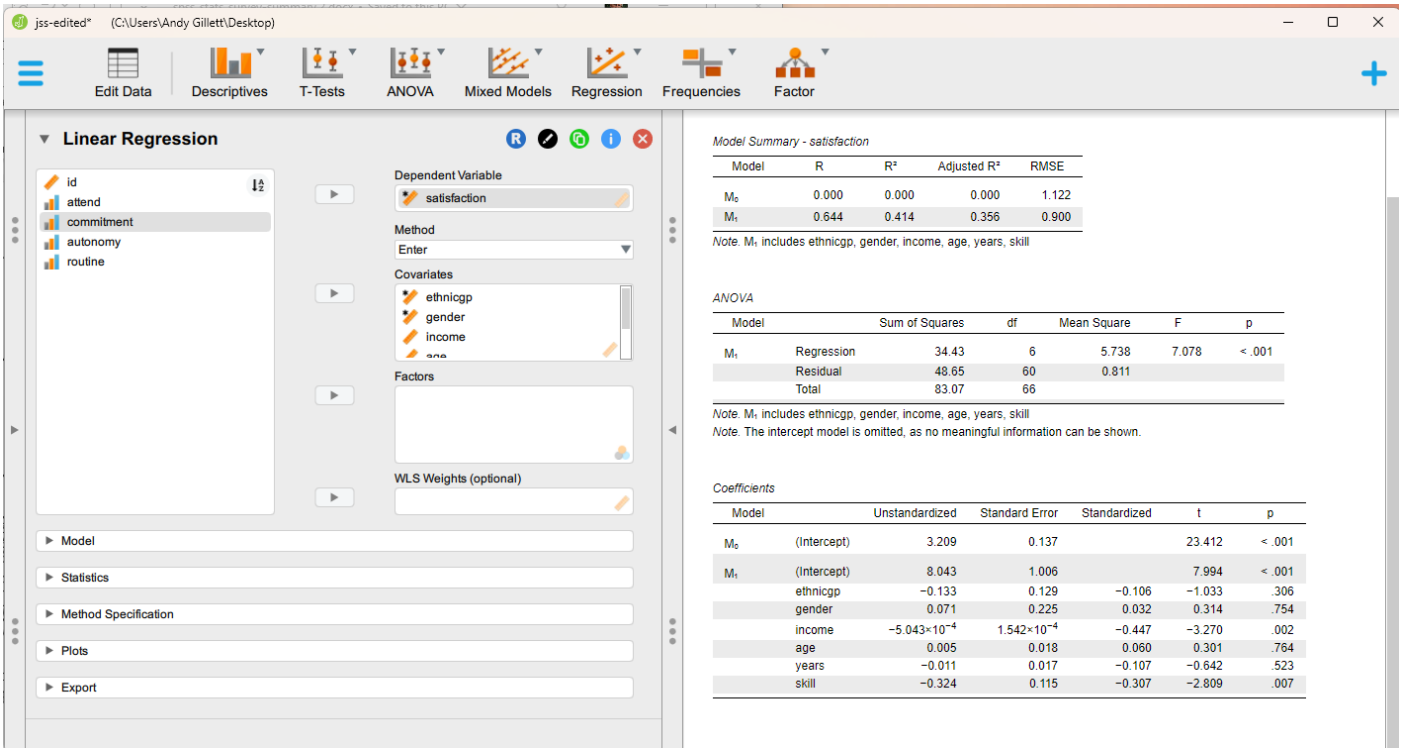
Spearman's Correlations ▼

			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]



Model Summary - satisfaction ▼

Model	R	R²	Adjusted R²	RMSE
M_0	0.000	0.000	0.000	1.122
M_1	0.644	0.414	0.356	0.900

Note. M_1 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

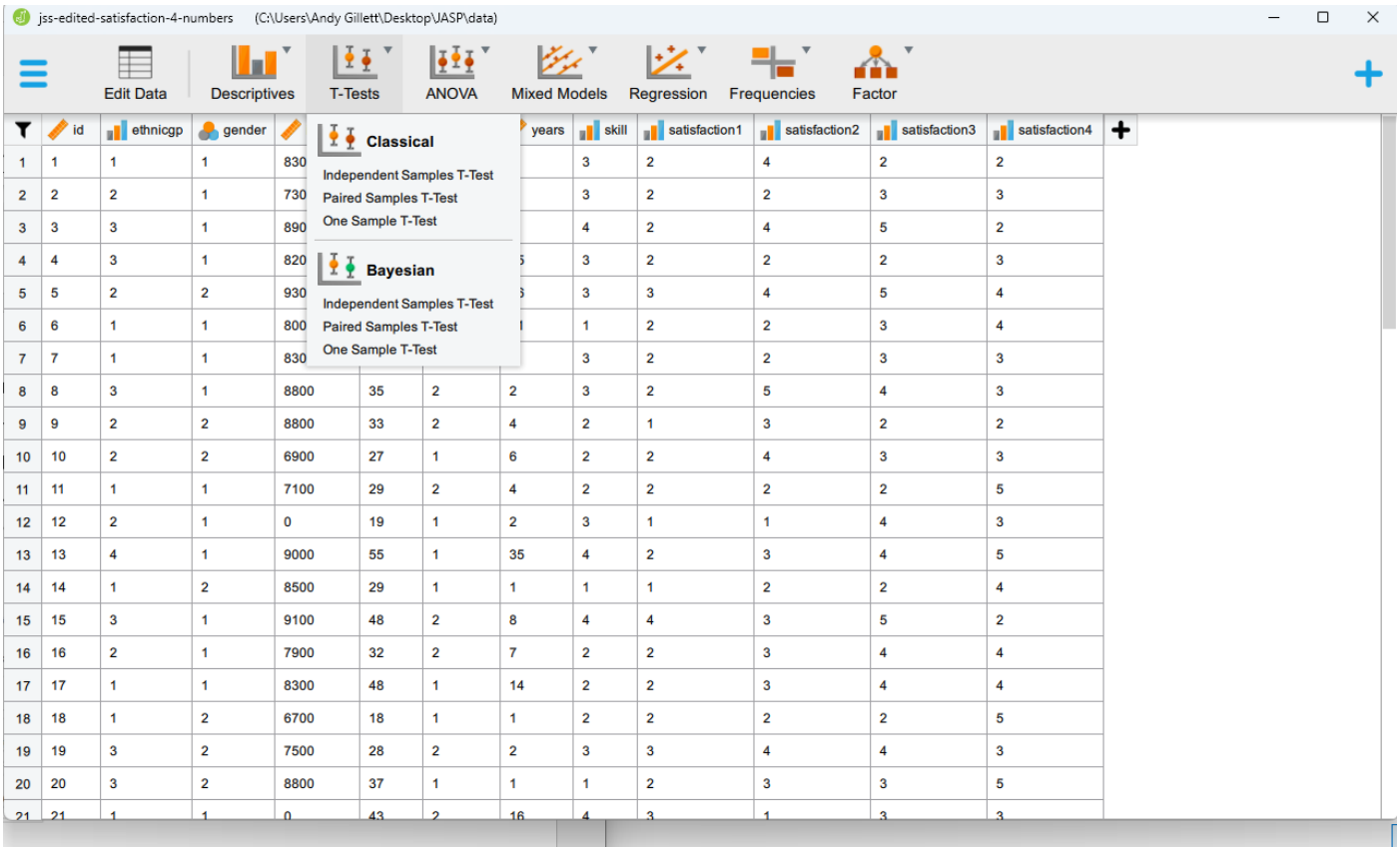
The most important predictor of job satisfaction is income – standardised coefficient is 0.45 followed by rated skill at 0.3

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

7. Changes in Job Satisfaction over time

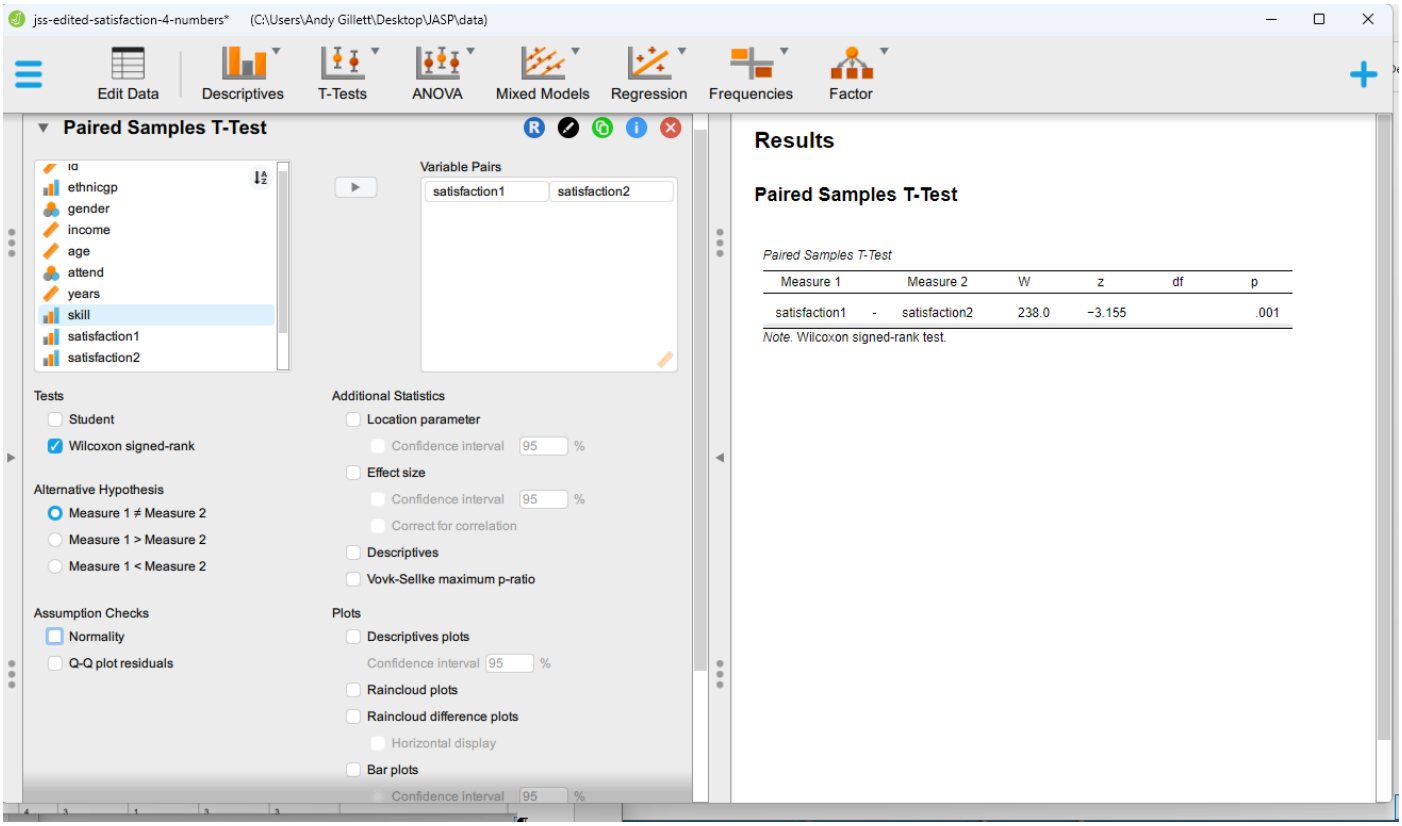
What about changes in Job Satisfaction at two different times?

[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

Paired Samples T-Test

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

Note. Wilcoxon signed-rank test.

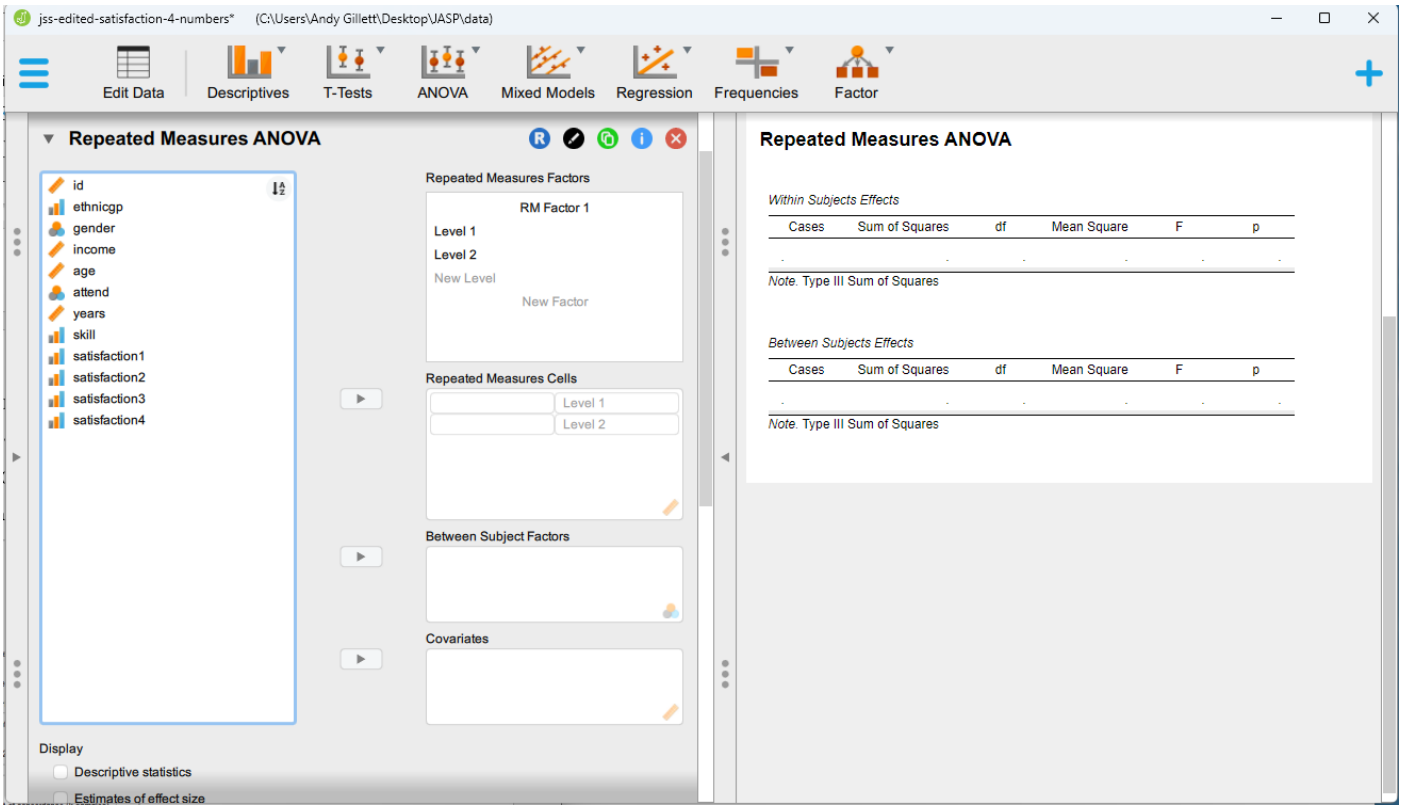
Satisfaction 1 = Time 1, Satisfaction 2 = Time 2

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

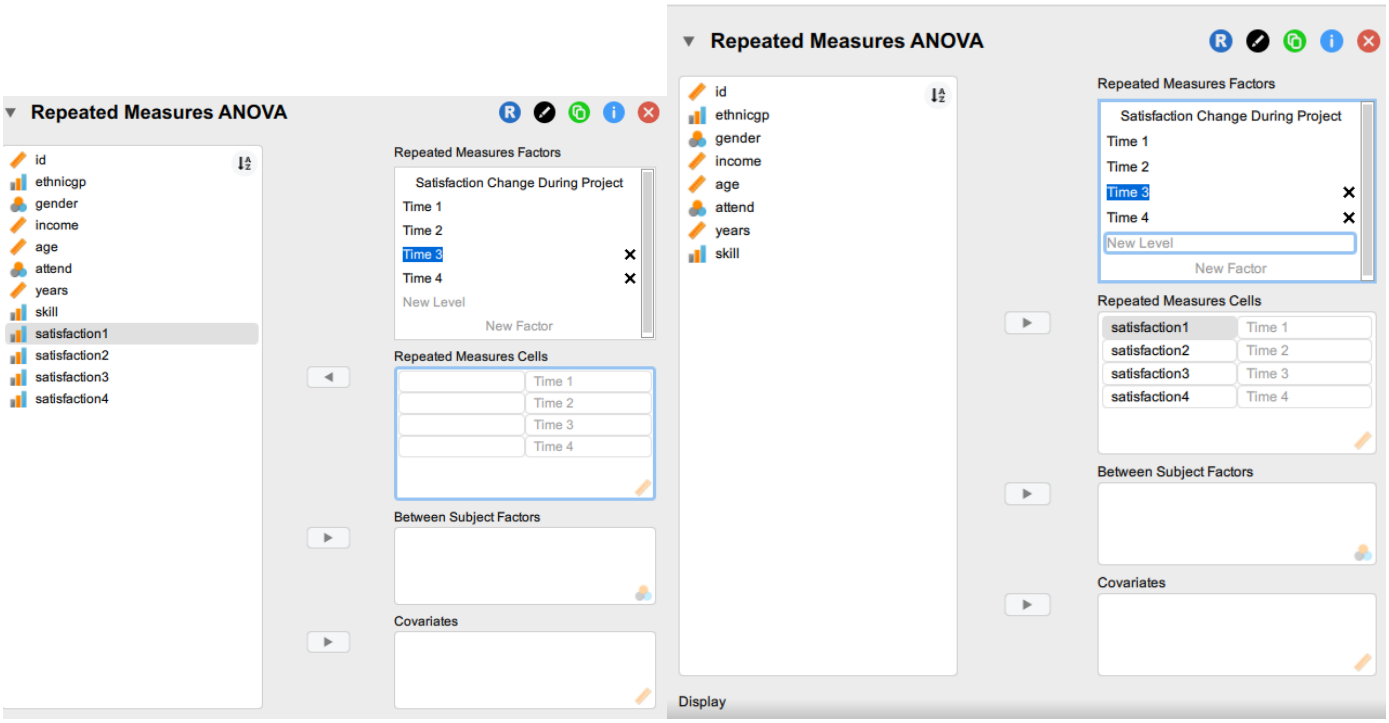
Do workers change their job satisfaction scores during a project?

[Analyses -> ANOVA - > Repeated Measures ANOVA]

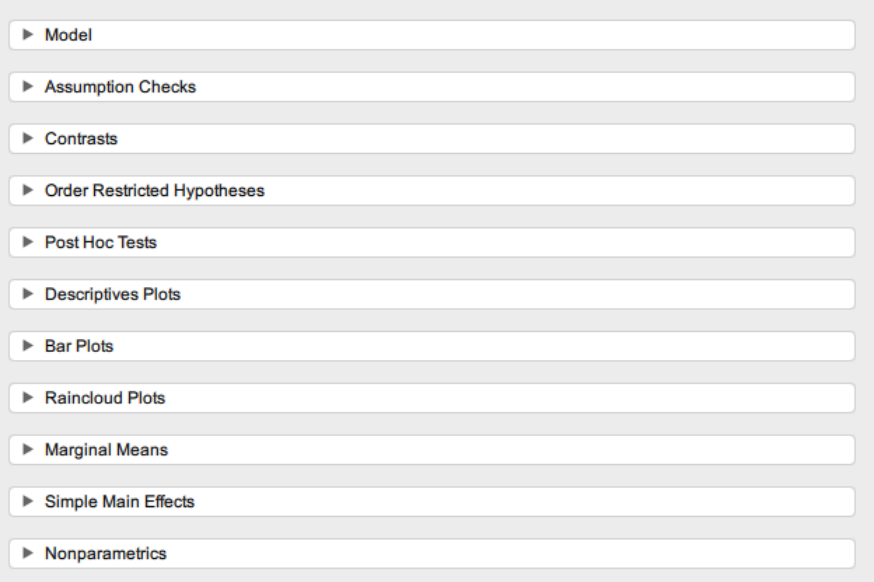


Change Title: Satisfaction Change Puring Project

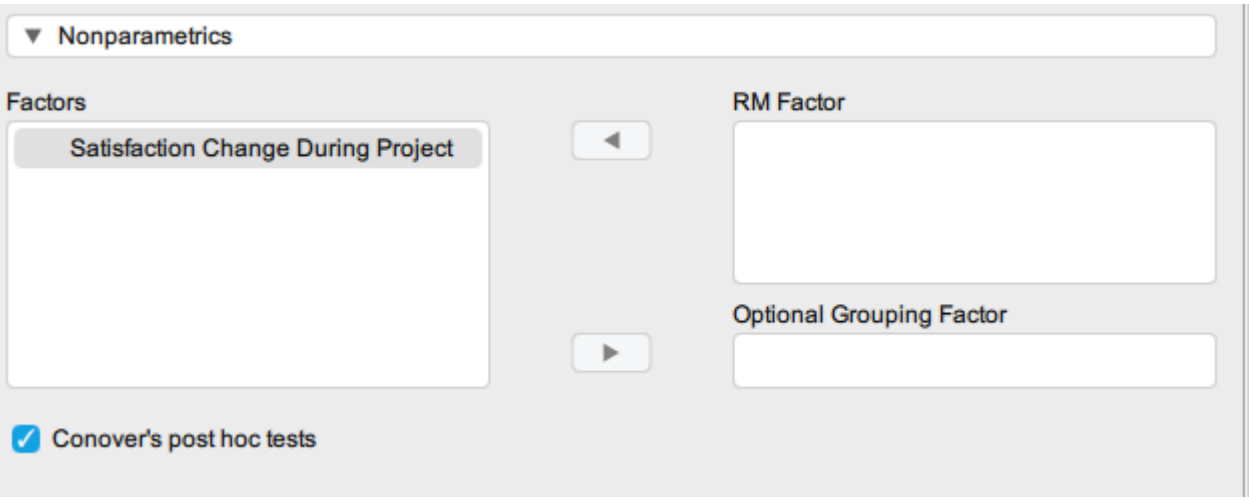
Define 4 Levels – Time 1-4. Move the data in Satisfaction 1-4.

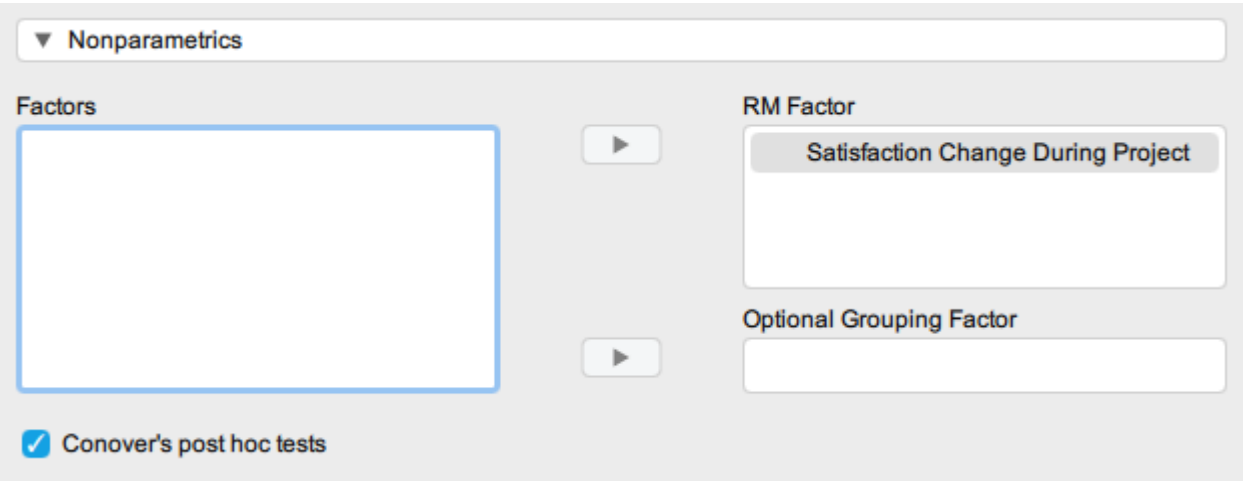


Choose Nonparametric



Move factor and choose Conover's post hoc test





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

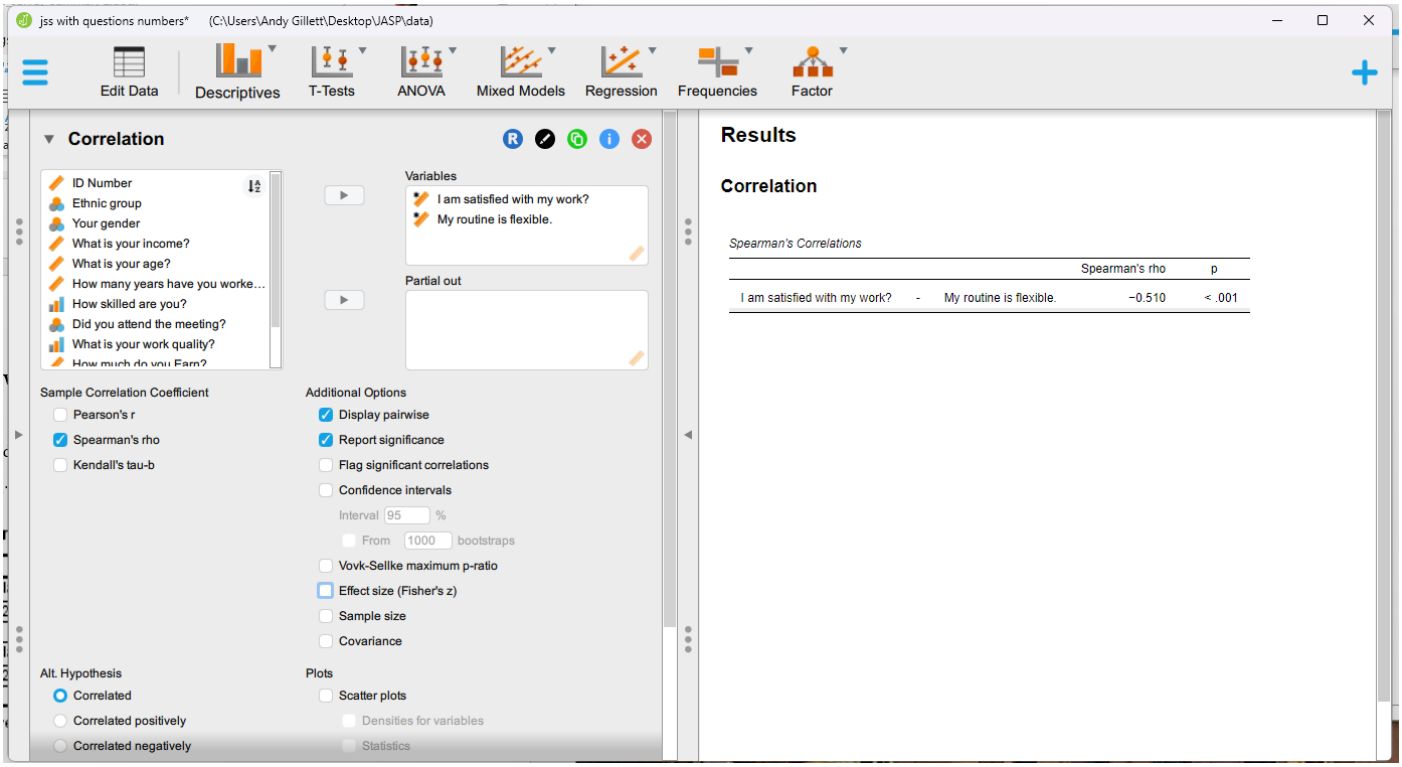
Pairwise comparisons show significant differences between Time 1 & Time 2, Time 1 & Time 3, Time 1 & Time 4, and Time 2 & Time 4 but not between Time 2 & Time 3 and Time 3 & Time 4.

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

[Analyses -> Regression -> Correlation]

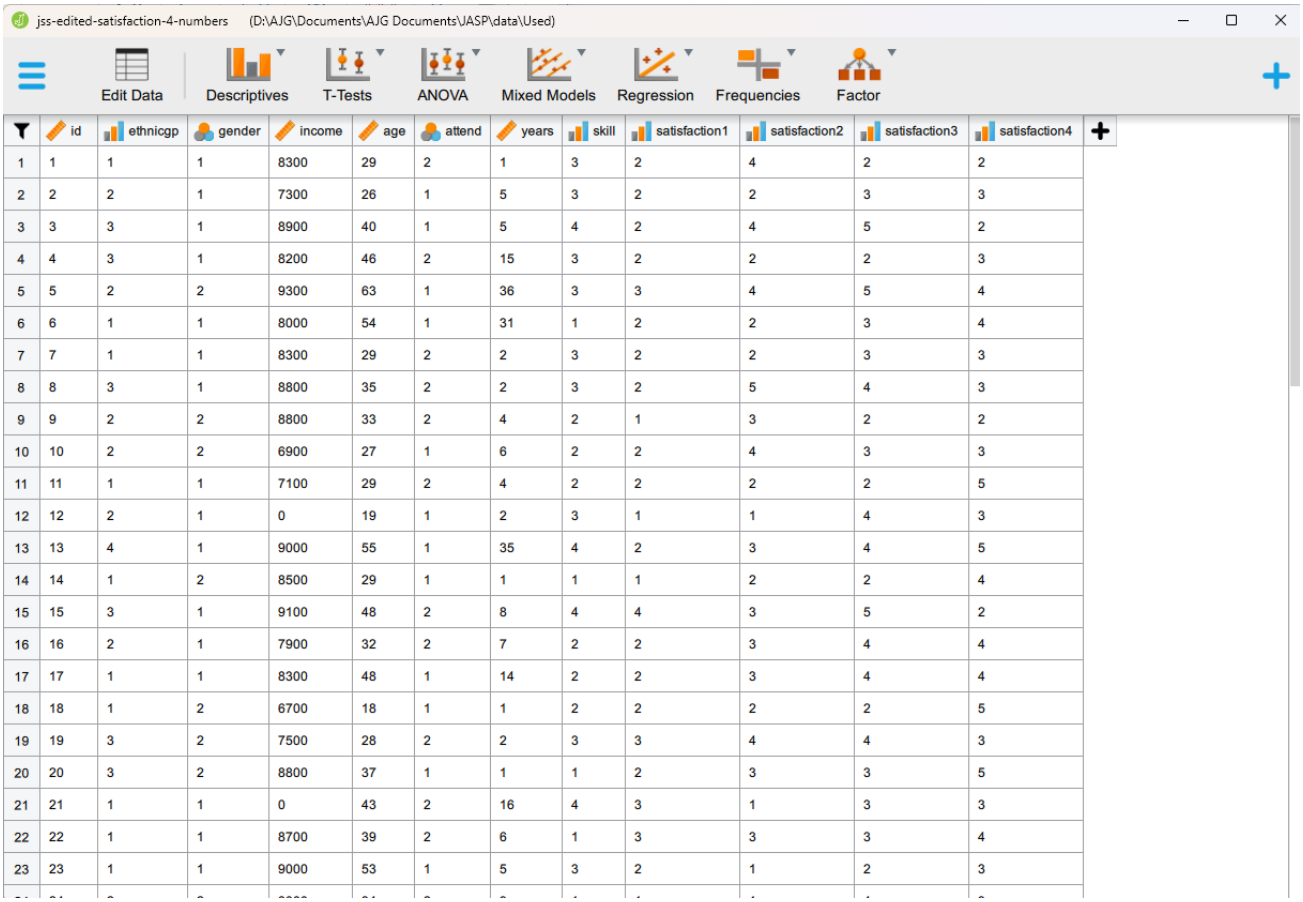
Choose Spearman, not Pearson, for ranked data

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



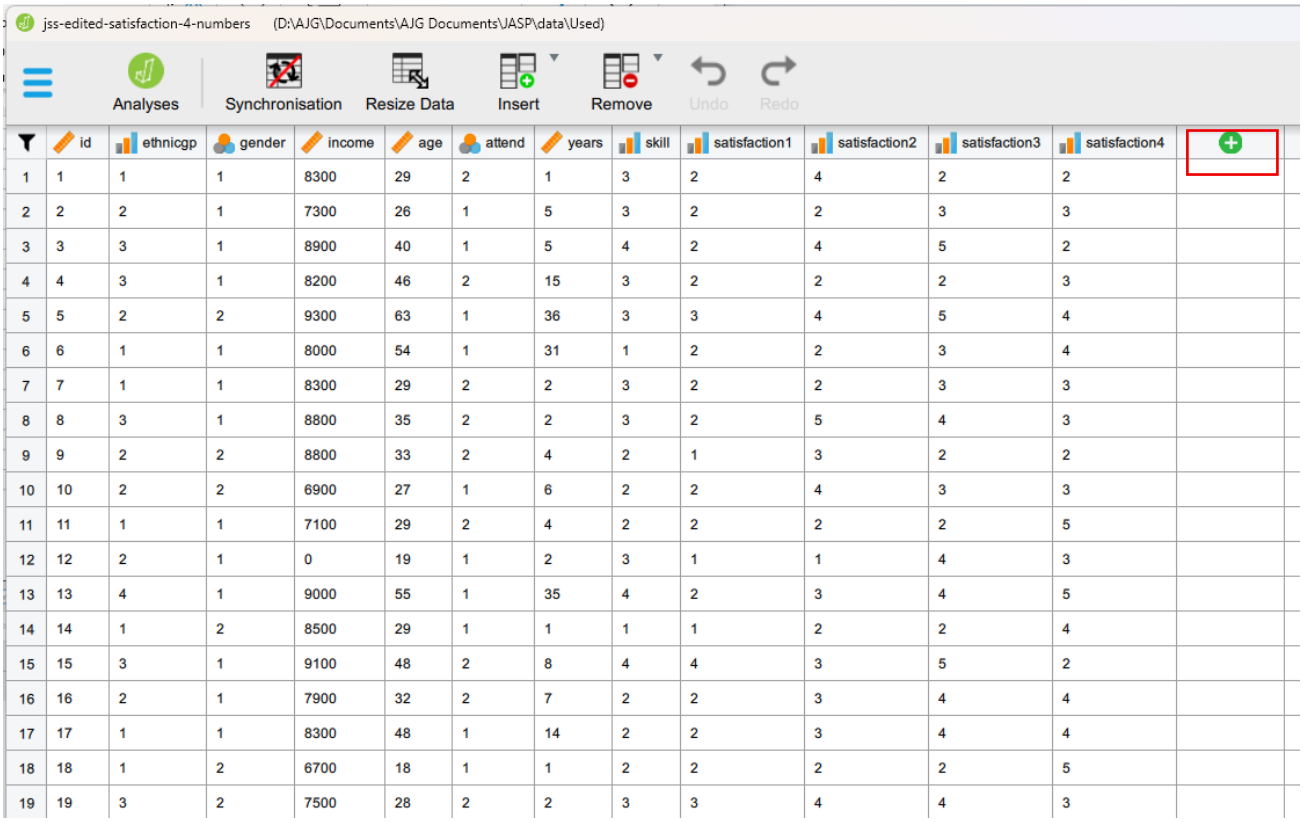
There is a significant relationship between autonomy and job satisfaction (< 0.001) & a strong correlation (0.510).

10. Summarising Likert Scale Results



	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]



	id	ethnicgp	gender	income	age	attend	years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4
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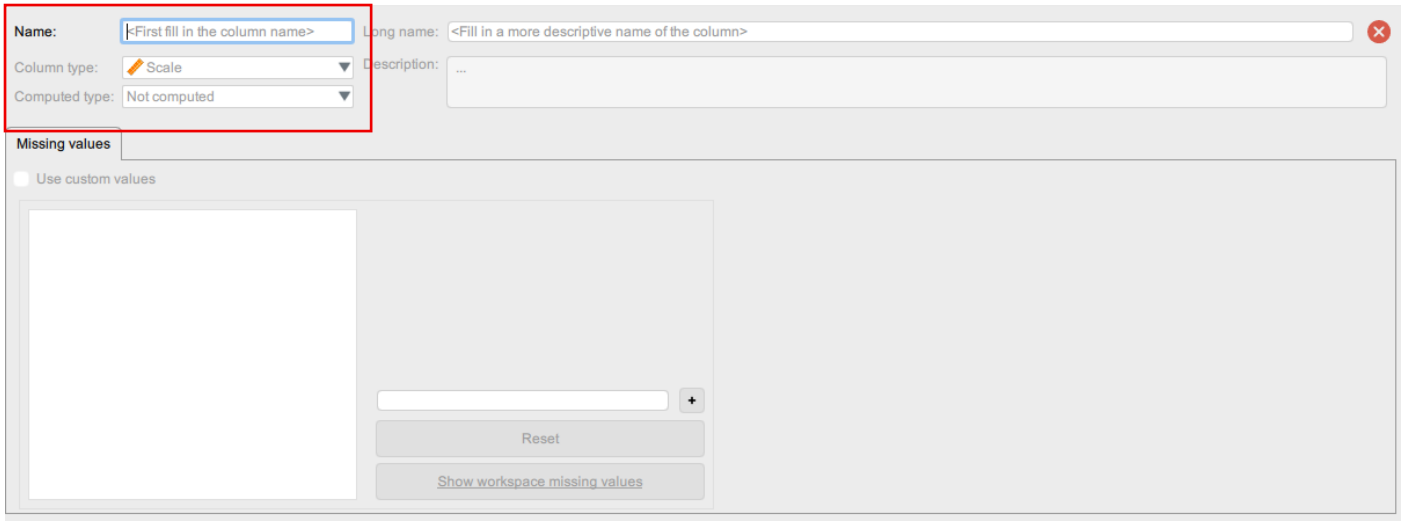

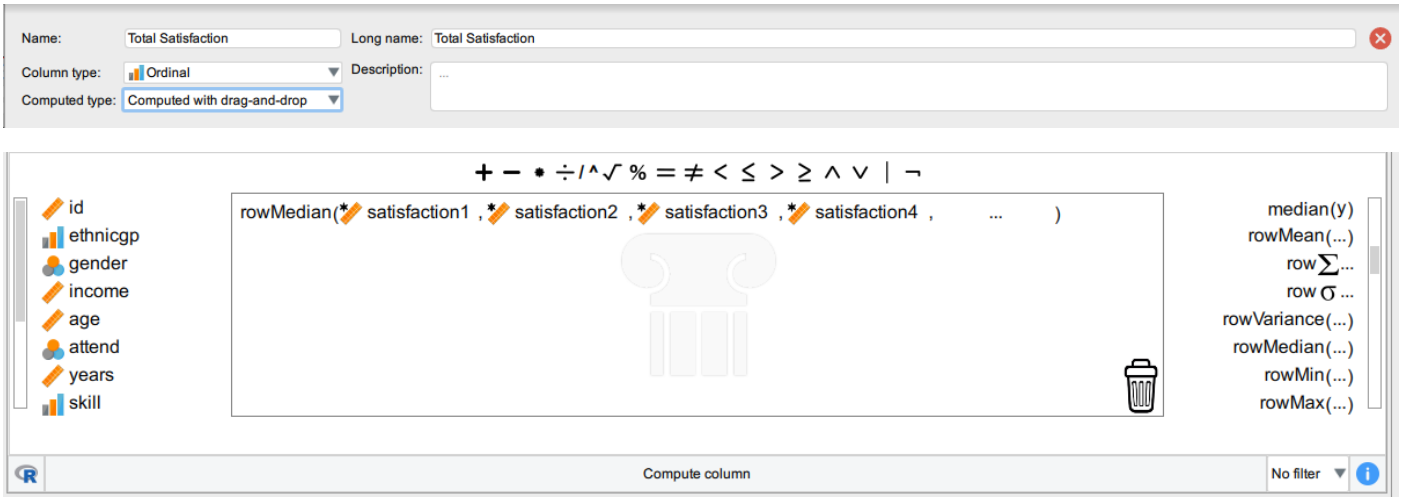

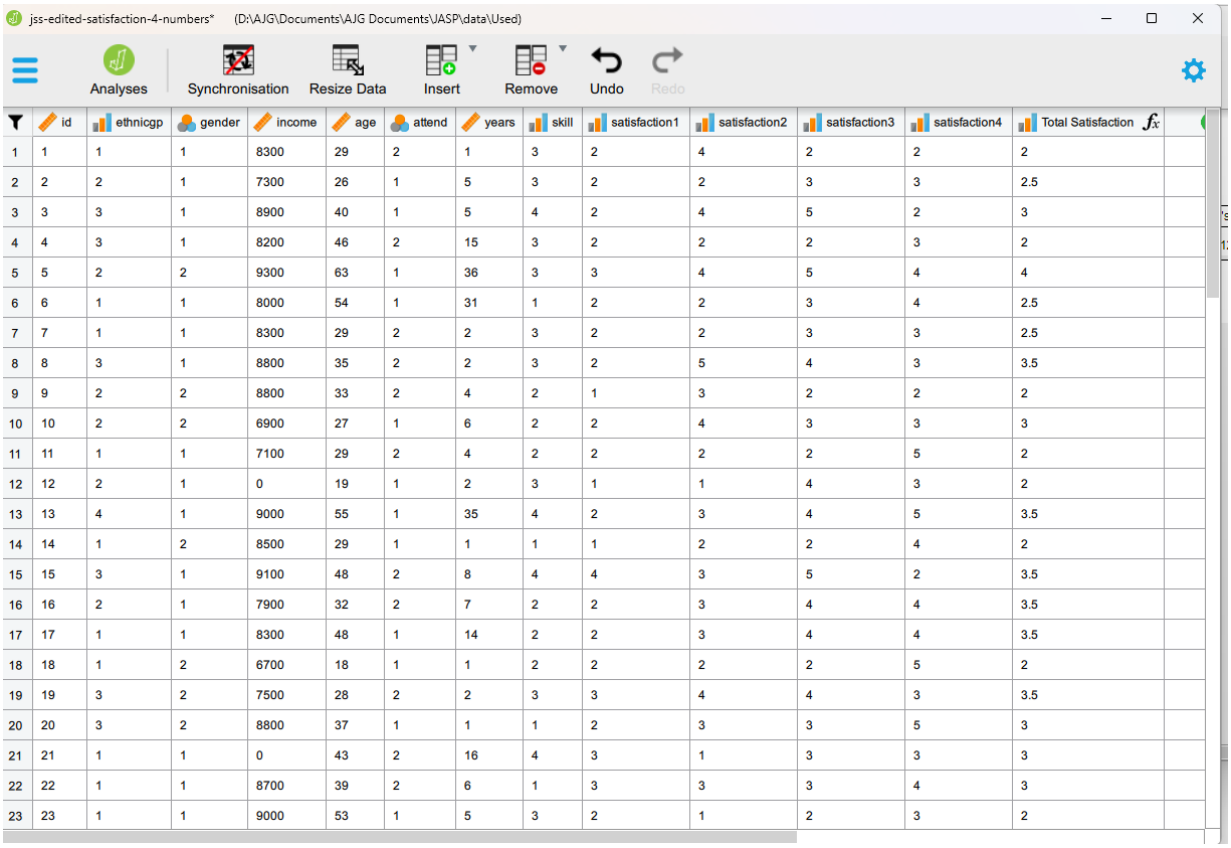

	id	ethnicgp	gender	income	age	attend	years	skill	satisfaction1	satisfaction2	satisfaction3	satisfaction4	Total Satisfaction
1	1	1	1	8300	29	2	1	3	2	4	2	2	2
2	2	2	1	7300	26	1	5	3	2	2	3	3	2.5
3	3	3	1	8900	40	1	5	4	2	4	5	2	3
4	4	3	1	8200	46	2	15	3	2	2	2	3	2
5	5	2	2	9300	63	1	36	3	3	4	5	4	4
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7	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

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