



Factorial ANOVA analysis on the use of AI tools based on population demographics and beliefs

This dataset is from a survey regarding the use of AI from people of various age groups, sex and beliefs. We will analyze the effect of various characteristics on the use frequency as well as potential interactions between them.

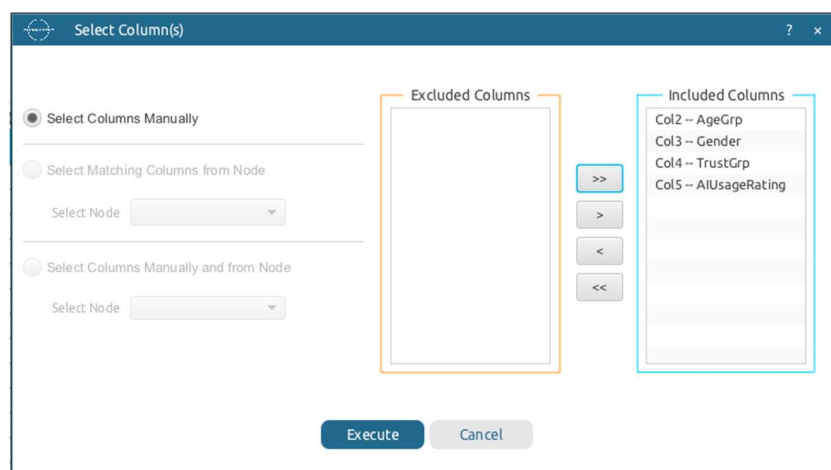
The variables examined are Usage Rating as a dependent variable and Age Group, Sex and Trust as factors. Dataset is modified to be used for Factorial ANOVA

Isalos version used: 2.1.5

Dataset: <https://www.kaggle.com/datasets/ardayavuzkeskin/the-impact-of-artificial-intelligence-on-society>

Step 1: Data preparation

Import dataset and rename the tab to “Data”. Go to Data Transformation → Data Manipulation → Select Column(s), transfer all columns to the “Included Columns” and click “Execute”



	Col1	Col2 (S)	Col3 (S)	Col4 (S)	Col5 (I)
User Header	User Row ID	AgeGrp	Gender	TrustGrp	AIUsageRating
1	1	Under25	Male	Undecided	4
2	2	Under25	Female	Distrust	3
3	3	Under25	Male	Undecided	3
4	4	Under25	Male	Undecided	2
5	5	Under25	Male	Undecided	1
6	6	Under25	Female	Distrust	3
7	7	Under25	Male	Undecided	2
8	8	Under25	Male	Undecided	1
9	9	Under25	Male	Trust	3
10	10	Under25	Female	Trust	4
11	11	Under25	Female	Distrust	1
12	12	Under25	Male	Trust	4
13	13	Under25	Female	Distrust	1
14	14	Under25	Female	Undecided	1
15	15	Under25	Female	Undecided	3
16	16	Under25	Male	Distrust	4
17	17	25plus	Male	Trust	3
18	18	25plus	Female	Undecided	2

Step 2a: Full Factorial ANOVA

Create a new tab named “Full Factorial” and import the spreadsheet from the “Data” tab. To perform the analysis, go to **Statistics** → **Analysis of (Co)Variance** → **Factorial ANOVA** and enter “95” for **Confidence Level (%)**, “AIUsageRating” as **Dependent Variable**, move all columns to **Factors** and select “Full Factorial” as **Formula Type**.

Factorial ANOVA

Confidence Level (%)

Dependent Variable

Sum of Squares for Tests

Coding for Factors

Excluded Columns

Factors

Col2 -- AgeGrp
Col3 -- Gender
Col4 -- TrustGrp

Specify Reference Le...

Formula Type: ☐ Custom ☐ Main Effects ☒ Full Factorial

Specify Custom Model Formula

Formula:

Residual Analysis & Assumption's Checks

Step 2b: Residual Analysis & Assumption's Checks

Click on Residual Analysis & Assumption's Checks and check the Shapiro-Wilk Test box under "Statistical Tests", Normal Q-Q Plots and Density Plot of Residuals boxes under "Plots". Check the Brown-Forsythe Test box under "Statistical Tests" and Violin Plot by Group box under "Plots". Click Save and then Execute.

Normality of Residuals

Statistical Tests

- ☒ Shapiro-Wilk Test
- ☐ Anderson-Darling Test
- ☐ Kolmogorov-Smirnov Test

Plots

- ☒ Normal Q-Q Plots
- ☐ Histogram of Residuals
- ☒ Density Plot of Residuals

Homogeneity of Variance (Homoscedasticity)

Statistical Tests

- ☐ Levene's Test
- ☒ Brown-Forsythe Test
- ☐ Bartlett's Test (for normal data)

Plots

- ☐ Residuals vs Fitted Values
- ☐ Residuals vs Dependent Variable
- ☐ Boxplots by Group
- ☒ Violin Plot by Group

Residual Diagnostics

Plots

- ☐ Residuals vs Observation Order

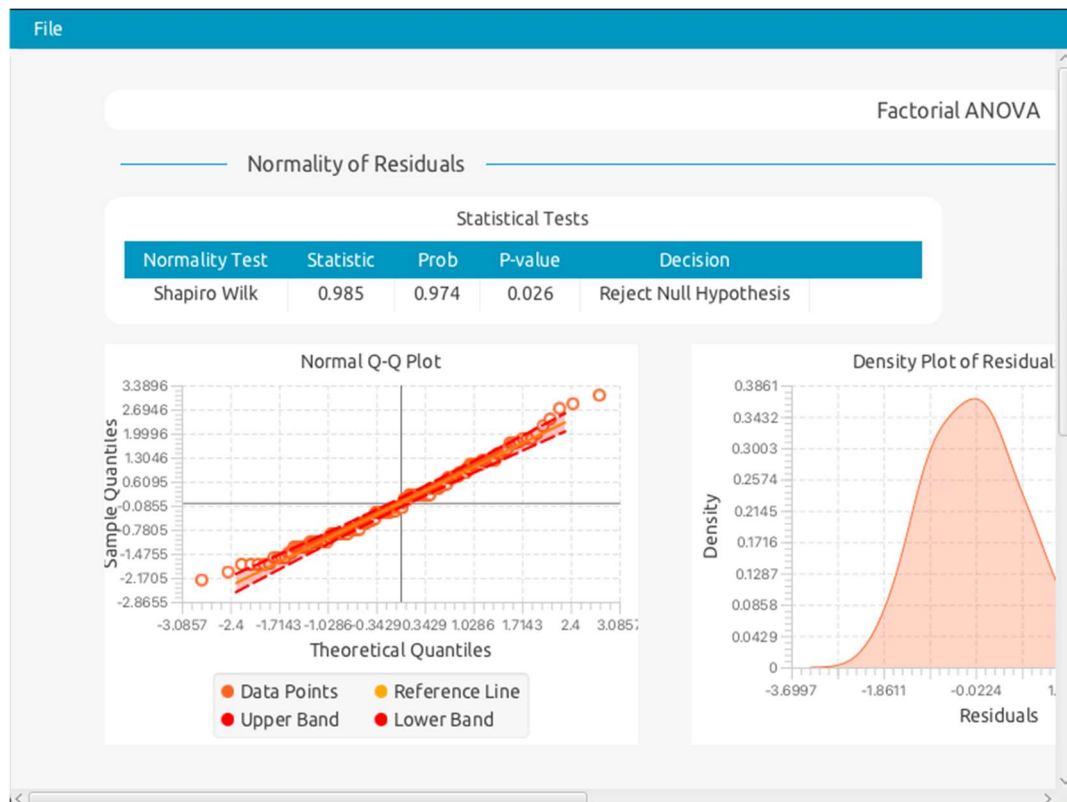
Model Adequacy

Plots

- ☐ Residuals vs Fitted values
- ☐ Residuals vs Each Factors

Buttons: Save, Cancel

A window with the tests results and requested plots appears:



Expand window to view all of the results and plots. Double-clicking on any plot opens it in a new window. The results are shown in the right spreadsheet:

	Col1	Col2 (S)	Col3 (I)	Col4 (D)	Col5 (D)	Col6 (D)	Col7 (D)	Col8 (S)
User Header	User Row ID	Source	DF	Adj SS	Adj MS	F-Value	P-Value	Significant
1		AgeGrp	1	38.5253364	38.5253364	36.7038252	0E-7	Yes
2		Gender	1	0.0386830	0.0386830	0.0368540	0.8479644	No
3		TrustGrp	2	24.2857994	12.1428997	11.5687729	0.0000180	Yes
4		AgeGrp*Gender	1	0.3613381	0.3613381	0.3442537	0.5580698	No
5		AgeGrp*TrustGrp	2	0.6841246	0.3420623	0.3258893	0.7222815	No
6		Gender*TrustGrp	2	13.1203208	6.5601604	6.2499903	0.0023439	Yes
7		AgeGrp*Gender*TrustGrp	2	1.5815646	0.7907823	0.7533934	0.4721457	No
8		Error	193	202.5780659	1.0496273			
9		Total	204	288.0780488				

Step 3: Reduced Factorial ANOVA

Create a new tab named “Reduced” and import the spreadsheet from the “Data” tab. To perform the analysis, go to **Statistics** → **Analysis of (Co)Variance** → **Factorial ANOVA** and enter “95” for **Confidence Level (%)**, “AiUsageRating” as **Dependent Variable**, move all columns to **Factors** and select “Custom” as **Formula Type**. Click **Specify Custom Model Formula**, select all columns from **Included Columns** and click **Add interactions up to order 2**, then, click **Save**. Click on **Residual Analysis & Assumption's Checks** and perform the tests like in Step 2b. Click **Execute**

Factorial ANOVA

Confidence Level (%)

Dependent Variable

Sum of Squares for Tests

Coding for Factors

Excluded Columns

Factors

Col2 -- AgeGrp
Col3 -- Gender
Col4 -- TrustGrp

Specify Reference Le...

Formula Type: ☒ Custom ☐ Main Effects ☐ Full Factorial

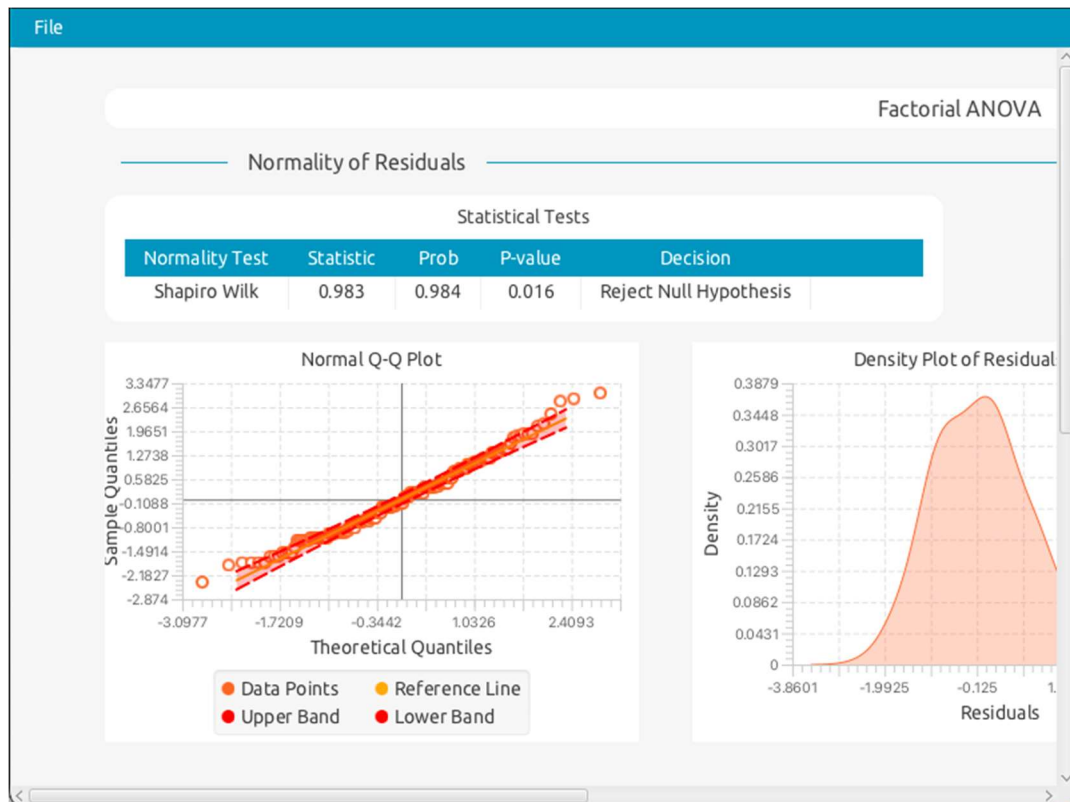
Specify Custom Model Formula

Formula:

Residual Analysis & Assumption's Checks

Execute **Cancel**

Test results and plots appear in a new window, analysis results are shown in right spreadsheet:



	Col1	Col2 (S)	Col3 (I)	Col4 (D)	Col5 (D)	Col6 (D)	Col7 (D)	Col8 (S)
User Header	User Row ID	Source	DF	Adj SS	Adj MS	F-Value	P-Value	Significant
1		AgeGrp	1	37.3718086	37.3718086	35.6951208	0E-7	Yes
2		Gender	1	0.0243549	0.0243549	0.0232622	0.8789348	No
3		TrustGrp	2	26.5704793	13.2852396	12.6891968	0.0000066	Yes
4		AgeGrp*Gender	1	0.4189755	0.4189755	0.4001781	0.5277384	No
5		AgeGrp*TrustGrp	2	0.7889106	0.3944553	0.3767581	0.6865804	No
6		Gender*TrustGrp	2	12.3853448	6.1926724	5.9148379	0.0032072	Yes
7		Error	195	204.1596304	1.0469725			
8		Total	204	288.0780488				

Step 4: Main Effects Factorial ANOVA

Create a new tab named “Main Effects” and import the spreadsheet from the “Data” tab. To perform the analysis, go to Statistics → Analysis of (Co)Variance → Factorial ANOVA and enter “95” for Confidence Level (%), “AiUsageRating” as Dependent Variable, move all columns to Factors and select “Main Effects” as Formula Type. Click on Residual Analysis & Assumption’s Checks and perform the tests like in Step 2b. Click Execute

Factorial ANOVA

Confidence Level (%)

Dependent Variable

Sum of Squares for Tests

Coding for Factors

Excluded Columns

Factors

Col2 -- AgeGrp
Col3 -- Gender
Col4 -- TrustGrp

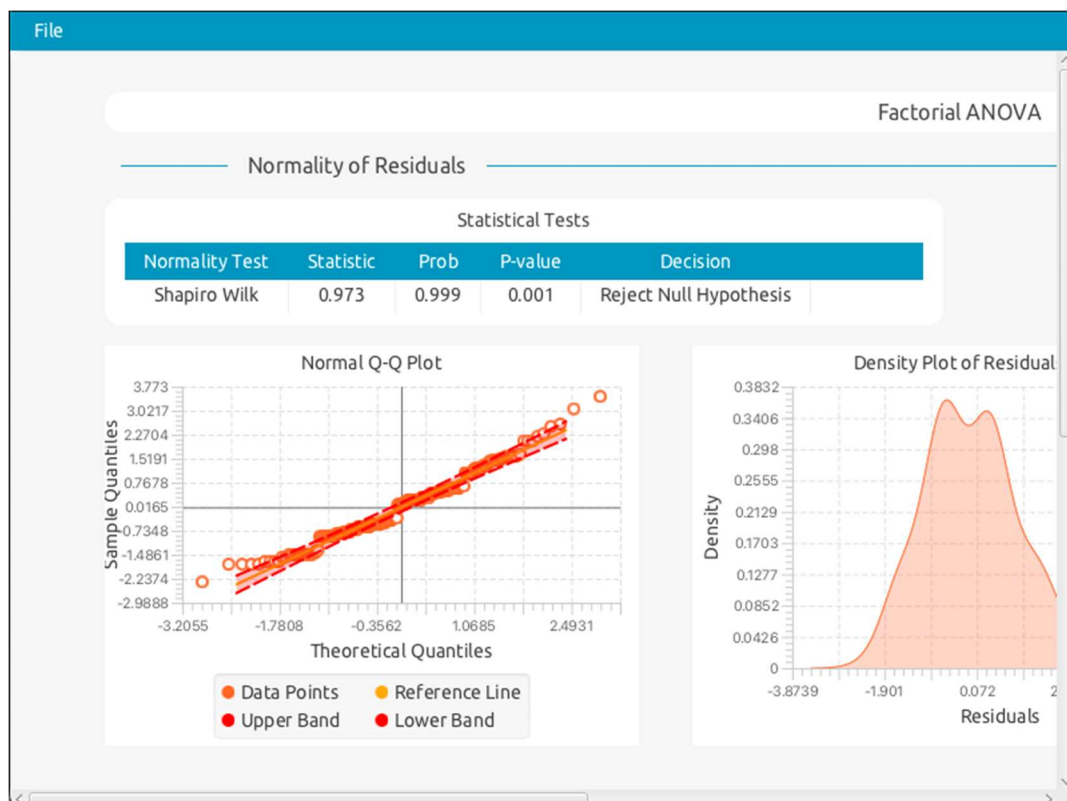
Specify Reference Le...

Formula Type: ☐ Custom ☒ Main Effects ☐ Full Factorial

Specify Custom Model Formula

Formula:

Test results and plots appear in a new window, analysis results are shown in right spreadsheet:



	Col1	Col2 (S)	Col3 (I)	Col4 (D)	Col5 (D)	Col6 (D)	Col7 (D)	Col8 (S)
User Header	User Row ID	Source	DF	Adj SS	Adj MS	F-Value	P-Value	Significant
1		AgeGrp	1	36.6689791	36.6689791	33.5466259	0E-7	Yes
2		Gender	1	0.3323442	0.3323442	0.3040452	0.5819730	No
3		TrustGrp	2	25.7484950	12.8742475	11.7780090	0.0000146	Yes
4		Error	200	218.6150058	1.0930750			
5		Total	204	288.0780488				

Final Isalos Workflow:

