

Twoway Analysis of Variance

Unlike previous problems in the manual, the present problem involves **two independent variables** (gender of juror and type of crime committed by defendant). There are two **levels** of gender of juror (male and female), and **three** levels of type of crime (assault, robbery, and rape). The dependent variable (sentence) is ratio scale data. Hence the present problem calls for a **2 x 3 twoway** analysis of variance. The researcher was a law psychologist who was interested in whether people administered harsher or light sentences to defendants convicted of one of three types of crimes (assault, robbery, or rape). S/he felt they would but didn't have any opinion as to which crime would receive the harshest sentence. The researcher also wanted to find out whether the gender of the juror would influence the length of sentence administered to a defendant and more specifically whether the gender of the juror would "interact" with the type of crime being processed. Specifically, the researcher felt that gender of juror was likely to be **unimportant** when trying a defendant for assault or robbery but felt that gender of juror would be important for the charge of rape. To test out their idea the researcher **randomly** assigned 9 female jurors to read one of three cases (3 **different** jurors per case). They read a case about either an assault, a robbery, or a rape. After reading the case the jurors were asked to assign a prison term (from 1 to 25 years of imprisonment) to the defendant for their crime. The researcher also followed the same procedure for a group of 9 male jurors. The males were also randomly assigned to read one of the three cases (3 **different** jurors per case). The researcher came up with the following number of years of imprisonment assigned by the jurors in each of the 6 conditions of the experiment.

	Column 1 Assault	Column 2 Robbery	Column 3 Rape
Female Jurors (Row 1 of gender)	4	5	12
	6	3	11
	8	7	13
Male Jurors (Row 2 of gender)	8	7	1
	6	3	2
	4	5	3

1. Logon to system
2. **Click Start > Programs > SPSS for Windows > SPSS 10.1 for Windows.** At this point a window will appear asking you what you would like to do. Click on the circle next to Type in Data (2nd option in list) and then click **OK** at the bottom of the window.
3. A Data Editor will appear. Look in the lower left corner of the screen. You should see a **Data View** tab and to the right of it a **Variable View** tab. The **Variable View** tab will be used first for the **Data Definition** Phase of creating a data file. The **Data View** tab will be used to actually enter the raw numbers listed above. (See pages 1-3 for a more detailed explanation of creating data files.)

DATA DEFINITION PHASE

4. Click on the **Variable View** tab in the lower left corner. A new screen will appear with the following words at the top of each column.
Name Type Width Decimals **Label** **Values** Missing Columns Align Measure
5. Click on the white cell in **Row 1** under the word **Name** and type in the word **Gender**
6. Click on the white cell in **Row 1** under the word **Label** and type in **Juror Gender**. (Doing this will provide you with a more expansive label in the results output).
7. Click on the white cell in **Row 1** under the word **Value**. The word none will appear along with a small grey

- box to the right.
- a. Click on the small grey box and a Value Labels window will appear
 - b. In the white box next to the word **Value**, type in the number **1**
 - c. Click on the white box next to the word **Value Label** and type **Female** (for female jurors)
 - d. Click the **Add** button. 1 = "**Female**" should now appear in the bottom white box.
 - e. In the white box next to the word **Value** type in the number **2**.
 - f. Click on the white box next to the word **Value Label** and type **Male** (for Male jurors).
 - g. Click the **Add** button. 2 = "**Male**" should now appear in the bottom white box also.
 - h. Click **OK**
8. Click on the white cell in **Row 2** under the word **Name**. Type in the word **Crime**
 9. Click on the white cell in **Row 2** under the word **Label** and type in **Crime Type** (Doing this will provide you with a more expansive label in the results output).
 10. Click on the white cell in **Row 2** under the word **Value**. The word none will appear along with a small grey box to the right.
 - a. Click on the small grey box and a Value Labels window will appear
 - b. In the white box next to the word **Value**, type in the number **1**
 - c. Click on the white box next to the word **Value Label** and type **Assault**
 - d. Click on the **Add** button. 1 = "**Assault**" should now appear in the bottom white box.
 - e. In the white box next to the word **Value** type in the number **2**.
 - f. Click on the white box next to the word **Value Label** and type **Robbery**
 - g. Click the **Add** button. 2 = "**Robbery**" should now appear in the bottom white box also.
 - h. In the white box next to the word **Value** type in the number **3**.
 - i. Click on the white box next to the word **Value Label** and type **Rape**
 - j. Click the **Add** button. 3 = "**Rape**" should now appear in the bottom white box also.
 - k. Click **OK**
 11. Click on the white cell in **Row 3** under the word **Name**. Type in the word **Sentence**.

DATA ENTRY PHASE

12. Click on the **Data View** tab in the lower left corner. The data **view** screen will now appear with Column 1 named **Gender** (for juror gender), Column 2 name **Crime** (for the type of crime) and Column 3 named **Sentence** (for the Sentence dependent variable).
13. Enter the data for the eighteen cases as follows: Click on the top left cell under the first column **Gender** and enter:

1 tab	1 tab	4 enter	Then mouse to the second row to enter the data for the second case.
1 tab	1 tab	6 enter	Then mouse to the third row to enter the data for the third case etc. for the remaining cases.
1 tab	1 tab	8 enter	
2 tab	1 tab	8 enter	
2 tab	1 tab	6 enter	
2 tab	1 tab	4 enter	
1 tab	2 tab	5 enter	
1 tab	2 tab	3 enter	
1 tab	2 tab	7 enter	
2 tab	2 tab	7 enter	
2 tab	2 tab	3 enter	
2 tab	2 tab	5 enter	
1 tab	3 tab	12 enter	
1 tab	3 tab	11 enter	
1 tab	3 tab	13 enter	
2 tab	3 tab	1 enter	
2 tab	3 tab	2 enter	
2 tab	3 tab	3 enter	

The data may also be entered down one column at a time entering all the code numbers for gender with 1 being female and 2 male, then moving on to column two and entering all the code numbers for crime with 1 being assault, 2 being robbery, and 3 being crime and then moving on to column 3 and entering the numbers for the sentence administered.

Data Analysis

1. Click on **Analyze** at top of screen then
 - a. Click on **General Linear Model** then
 - b. Click on **Univariate**
2. Highlight the word **Sentence** by clicking on it then
 - a. Click on **arrow >** to transfer this name to the **Dependent Box**
3. Highlight the word **Crime** by clicking on it then
 - a. Click on **arrow >** to transfer this name to the **Fixed Factor(s) Box**.
4. Highlight the word **Gender** by clicking on it then
 - a. Click on **arrow >** to transfer this name to the **Fixed Factor(s) Box**.
5. Click on **Options** Button
 - a. Highlight the word **Crime** by clicking on it then
 - b. Click on **Arrow >** to transfer this name to the **Display Means Box**.
 - c. Highlight the word **Gender** by clicking on it then
 - d. Click on **Arrow >** to transfer this name to the **Display Means Box**.
 - e. Highlight the words **crime*gender** by clicking on it then
 - f. Click on **Arrow >** to transfer this name combination to the **Display Means Box**.
6. Click on white square next to the words **descriptive statistics** to put a check mark in the box
7. Click **Continue**
8. Click **OK**
9. Your results will appear in a Window. Scroll up using the slide bar on the right to the top of the output. The results of this analysis are presented below.

Descriptive Statistics

Dependent Variable: SENTENCE

Crime Type	Juror Gender	Mean	Std. Deviation	N
Assault	Females	6.0000	2.00000	3
	Males	6.0000	2.00000	3
	Total	6.0000	1.78885	6
Robbery	Females	5.0000	2.00000	3
	Males	5.0000	2.00000	3
	Total	5.0000	1.78885	6
Rape	Females	12.0000	1.00000	3
	Males	2.0000	1.00000	3
	Total	7.0000	5.54977	6
Total	Females	7.6667	3.60555	9
	Males	4.3333	2.34521	9
	Total	6.0000	3.41278	18

Tests of Between-Subjects Effects

Dependent Variable: SENTENCE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	162.000 ^a	5	32.400	10.800	.000
Intercept	648.000	1	648.000	216.000	.000
CRIME	12.000	2	6.000	2.000	.178
GENDER	50.000	1	50.000	16.667	.002
CRIME * GENDER	100.000	2	50.000	16.667	.000
Error	36.000	12	3.000		
Total	846.000	18			
Corrected Total	198.000	17			

a. R Squared = .818 (Adjusted R Squared = .742)

1. Crime Type

Dependent Variable: SENTENCE

Crime Type	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Assault	6.000	.707	4.459	7.541
Robbery	5.000	.707	3.459	6.541
Rape	7.000	.707	5.459	8.541

2. Juror Gender

Dependent Variable: SENTENCE

Juror Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Females	7.667	.577	6.409	8.925
Males	4.333	.577	3.075	5.591

3. Crime Type * Juror Gender

Dependent Variable: SENTENCE

Crime Type	Juror Gender	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Assault	Females	6.000	1.000	3.821	8.179
	Males	6.000	1.000	3.821	8.179
Robbery	Females	5.000	1.000	2.821	7.179
	Males	5.000	1.000	2.821	7.179
Rape	Females	12.000	1.000	9.821	14.179
	Males	2.000	1.000	-.179	4.179

10. For the problem above the null and alternative hypotheses are spelled out below:

- H_{null}:
- a) The means of the two gender conditions will be equal. (There will be no main effect for gender)
 - b) The means of the three crime conditions will be equal. (There will be no main effect for crime)
 - c) The pattern of females' responses to the three types of crimes will be identical to the pattern of males' responses to the three types of crimes. (There will be no interaction between gender of juror and type of crime.)
- H_{alt}:
- a) The means of the two gender conditions will not be equal.
 - b) The means of the three crime conditions will not be equal.
 - c) There will be an interaction between juror gender and type of crime such that the pattern of female's responses to the three types of crimes will not be identical to the pattern of males' responses to the three types of crimes.

11. Interpretation and APA writing template for Results Above

A 2 x 3 two way analysis of variance was conducted to determine whether juror gender and type of crime influenced how participant's sentenced the defendant. Results of that analysis indicated no main effect for type of crime, $F(2,12) = 2.00, p > .05$. The mean sentences for the crimes of assault, robbery, and rape were respectively $M = 6.00, M = 5.00$, and $M = 7.00$. Results did indicate a main effect for juror gender, $F(1,12) = 16.667, p < .05$, with females ($M = 7.67$) administering longer sentences than males ($M = 4.33$). The main effect for juror gender, however, gets qualified by a significant juror gender by type of crime interaction, $F(2,12) = 16.667, p < .05$. A post ANOVA Tukey test comparing the interaction means indicated female and male jurors responded in similar ways to the crimes of assault ($M = 6.00$ for both females and males) and robbery ($M = 5.00$ for both females and males). Female jurors, however, administered a significantly harsher sentence to the rapist ($M = 12.00$) than male jurors ($M = 2.00$), $p < .05$.