SPSS Chapter 16 Example 1 – TwoWay ANOVA

Consider the following 2 factor experiment based on Gebotys and Roberts (1988) where a social psychologist is interested in the effect of a type of CRIME with 3 levels:

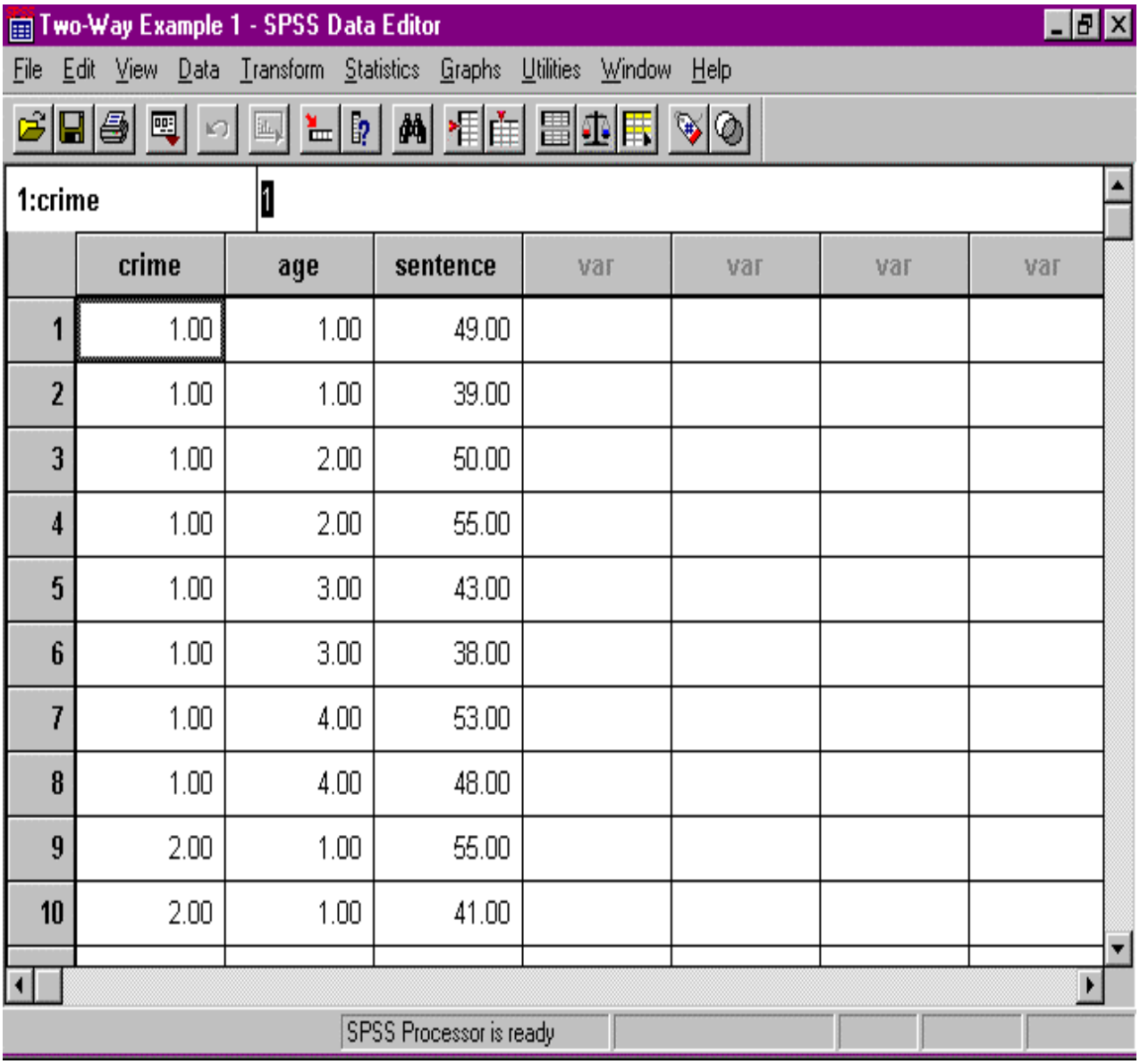
A_1 - break and enter
A_2 - sexual assault
A_3 - manslaughter

and AGE with 4 levels:

B_1 - 20 years old
B_2 - 30 years old
B_3 - 40 years old
B_4 - 50 years old

On the sentencing (in months) of offenders.
Short descriptions which factorially combined the two factors were given to subjects who were asked to sentence the offender. Each person only responded to one description. There are two people per treatment for a total sample of 3 x 4 x 2 = 24.

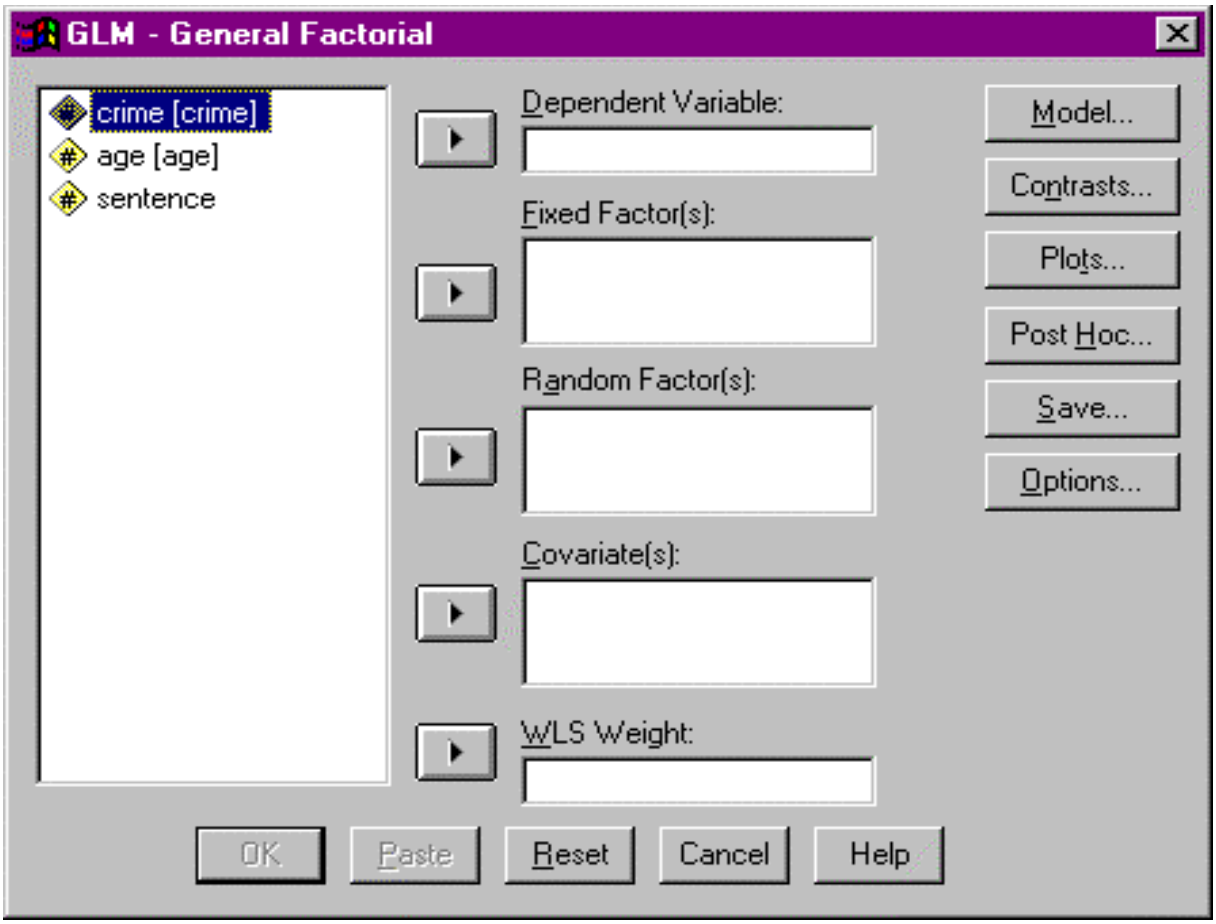
After opening the file, the data appear in the SPSS Sata Editor window just like the following:



	crime	age	sentence	var	var	var	var
1	1.00	1.00	49.00				
2	1.00	1.00	39.00				
3	1.00	2.00	50.00				
4	1.00	2.00	55.00				
5	1.00	3.00	43.00				
6	1.00	3.00	38.00				
7	1.00	4.00	53.00				
8	1.00	4.00	48.00				
9	2.00	1.00	55.00				
10	2.00	1.00	41.00				

Follow these steps to perform a Two-Way ANOVA:

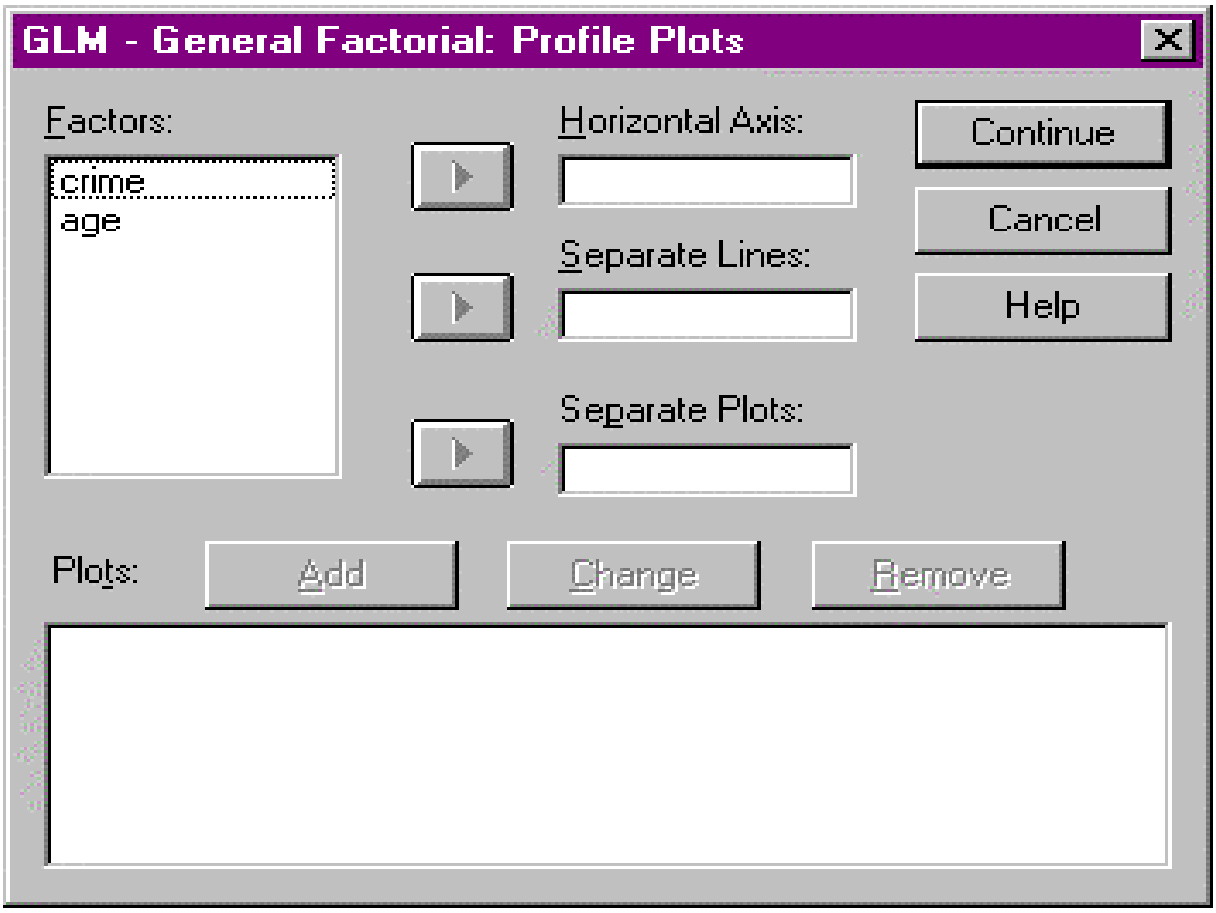
1. Click **Analyse**, click **General Linear Model**, and click **Univariate** The following window will appear.



2. Click **"sentence"** and click the arrow to move **"sentence"** into the box entitled **Dependent Variable**.

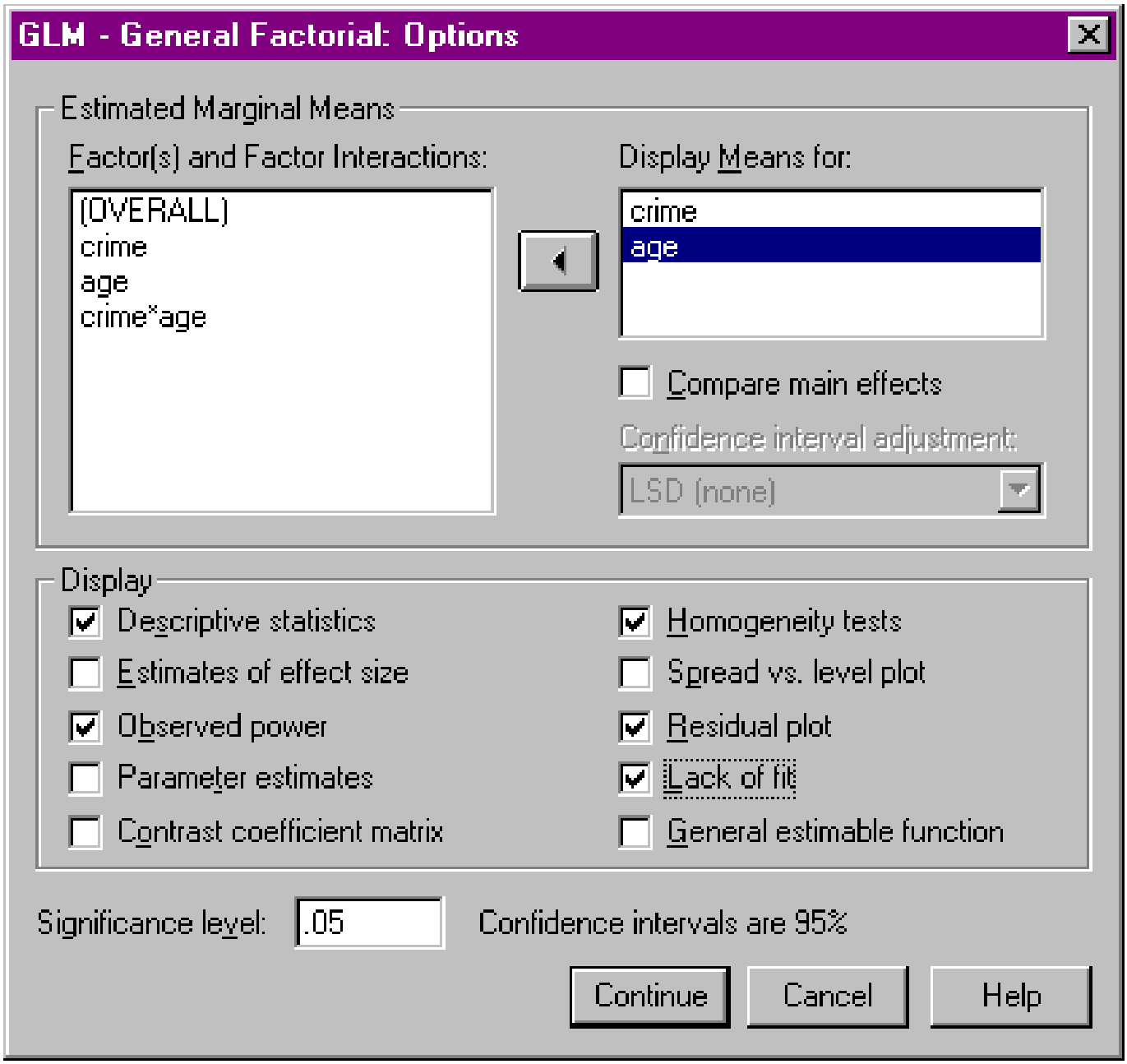
3. Click **"crime"** and **"age"** and click the arrow to move **"crime"** and **"age"** into the box entitled **Fixed Factors(s)**.

4. To create a means plot, click the button entitled **Plots** and the following window will appear.



5. Click **"crime"** and click the arrow to move **"crime"** into the box entitled **Horizontal Axis**. Click **"age"** and click the arrow to move **"age"** into the box entitled **Separate Lines**. Click **Add** and click **Continue**.

6. To obtain summary statistics and other useful information click the **Options** box. The following window will appear.



7. Click on **"crime"** and click the arrow to move crime into the **Display Means** box. Move **"age"** into the **Display Means** box using the same method.

8. Click on **Descriptive statistics**, **Homogeneity tests**, **Residual plot**, **Observed power**, and **Lack of fit**. Click **Continue**.

9. Click **OK**.

The SPSS output for this example of the Two-Way ANOVA is the following:

Between-Subjects Factors

		Value Label	N
crime	1.00	break & enter	8
	2.00	sexual assault	8
	3.00	manslaughter	8
age	1.00	20 years old	6
	2.00	30 years old	6
	3.00	40 years old	6
	4.00	50 years old	6

Descriptive Statistics

Dependent Variable: SENTENCE

crime	age	Mean	Std. Deviation	N
break & enter	20 years old	44.0000	7.0711	2
	30 years old	52.5000	3.5355	2
	40 years old	40.5000	3.5355	2
	50 years old	50.5000	3.5355	2
	Total	46.8750	6.2664	8
sexual assault	20 years old	48.0000	9.8995	2
	30 years old	62.5000	6.3640	2
	40 years old	47.5000	7.7782	2
	50 years old	79.0000	8.4853	2
	Total	59.2500	15.1257	8
manslaughter	20 years old	67.0000	1.4142	2
	30 years old	88.5000	4.9497	2
	40 years old	65.5000	4.9497	2
	50 years old	92.0000	9.8995	2
	Total	78.2500	13.7087	8
Total	20 years old	53.0000	12.2801	6
	30 years old	67.8333	17.0812	6
	40 years old	51.1667	12.3518	6
	50 years old	73.8333	19.9240	6
	Total	61.4583	17.6782	24

Levene's Test of Equality of Error Variances[a]

Dependent Variable: SENTENCE

F	df1	df2	Sig.
.	11	12	.

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+AGE+CRIME+AGE * CRIME

Tests of Between-Subjects Effects

Dependent Variable: SENTENCE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Corrected Mode	6680.458[b]	11	607.314	14.360	.000	157.962	1.000
Intercept	90651.042	1	90651.042	2143.473	.000	2143.473	1.000
AGE	2227.458	3	742.486	17.556	.000	52.669	1.000
CRIME	3996.083	2	1998.042	47.244	.000	94.489	1.000
AGE * CRIME	456.917	6	76.153	1.801	.182	10.804	.453
Error	507.500	12	42.292				
Total	97839.000	24					
Corrected Total	7187.958	23					

a. Computed using alpha = .05

b. R Squared = .929 (Adjusted R Squared = .865)

Note the main effects of age and crime are very significant. The F statistics are 17.56 and 47.24 with 3 and 12 degrees of freedom and 2 and 12 degrees of freedom for age and crime respectively. The interaction is not significant. The p value is .18. The means for the main effects would now be reported. If the interaction was significant a graph would be presented to help understand the nature of the interaction.if apriori contrasts are available they would be used to further study the main effects and interaction on a 1 df basis see class notes.

Lack of Fit Tests

Dependent Variable: SENTENCE

Source	Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Lack of Fit	.000	0	.	.	.	.000	.
Pure Error	507.500	12	42.292				

a. Computed using alpha = .05

Estimated Marginal Means

1. age

Dependent Variable: SENTENCE

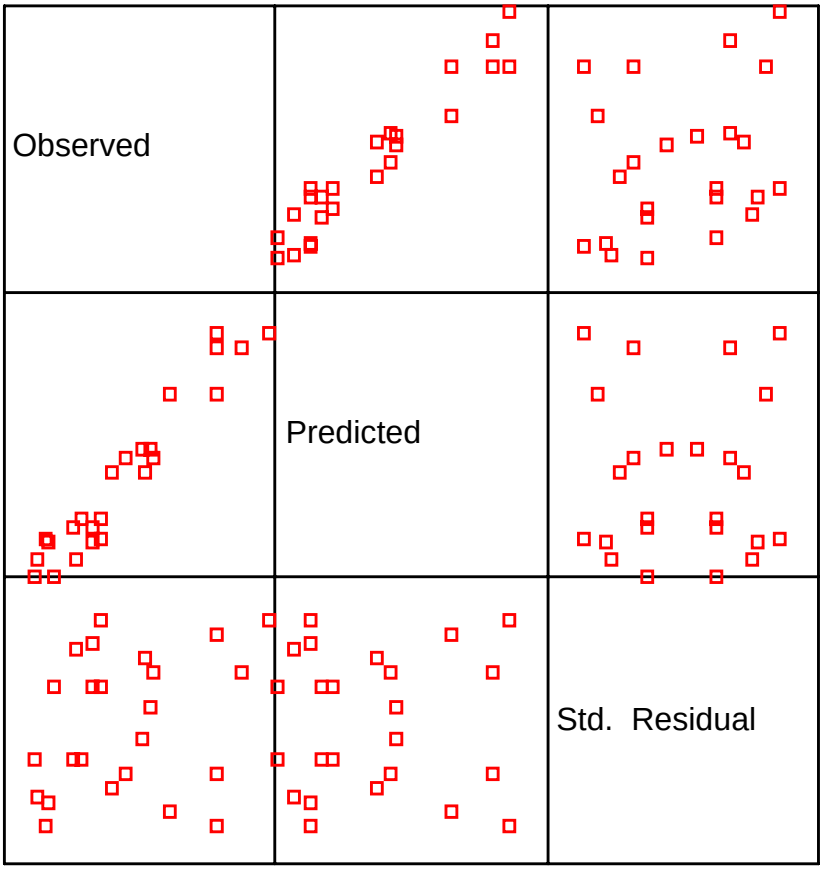
age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
20 years old	53.000	2.655	47.215	58.785
30 years old	67.833	2.655	62.049	73.618
40 years old	51.167	2.655	45.382	56.951
50 years old	73.833	2.655	68.049	79.618

2. age

Dependent Variable: SENTENCE

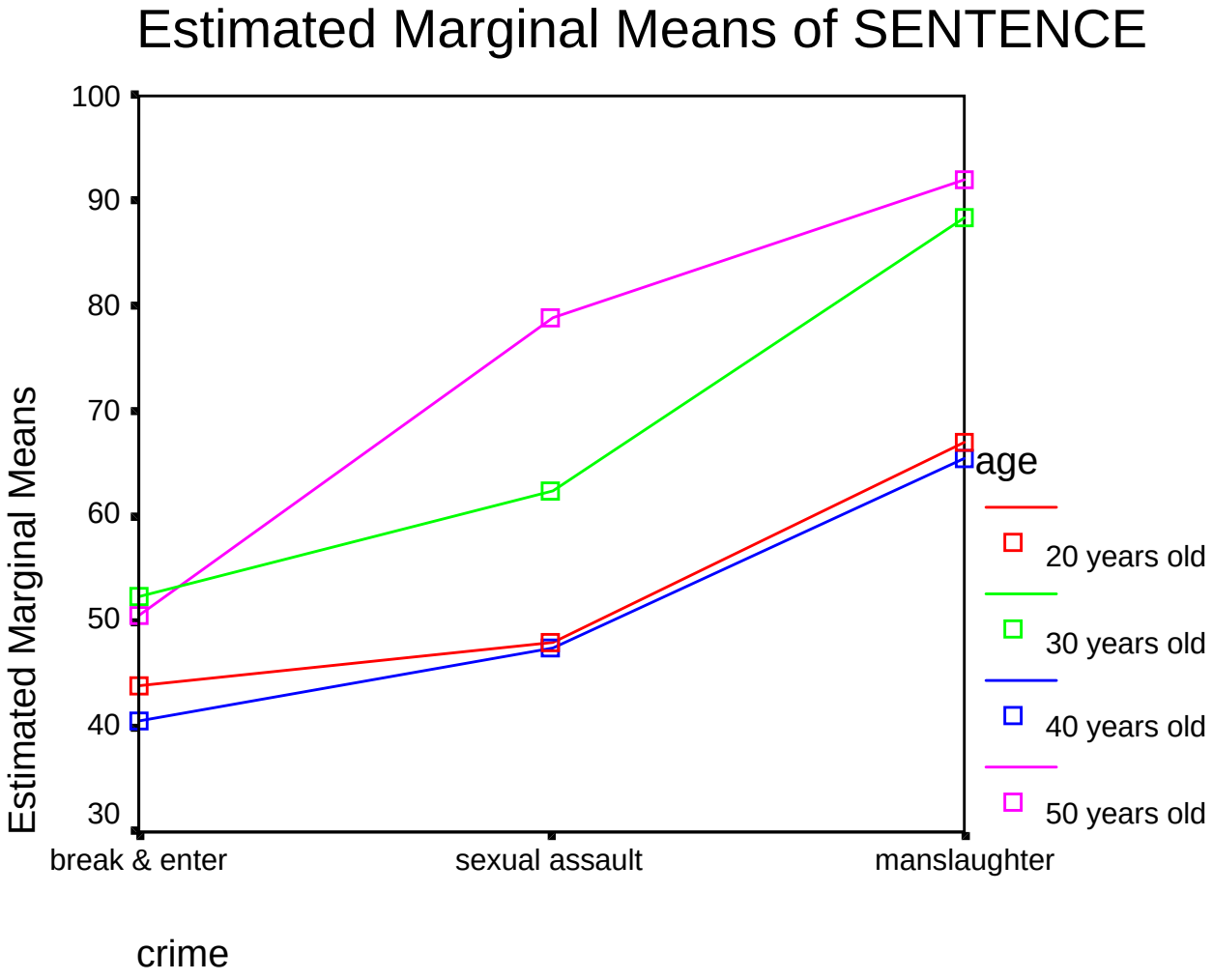
age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
20 years old	53.000	2.655	47.215	58.785
30 years old	67.833	2.655	62.049	73.618
40 years old	51.167	2.655	45.382	56.951
50 years old	73.833	2.655	68.049	79.618

Dependent Variable: SENTENCE



Model: Intercept + AGE + CRIME + AGE*CRIME

Note the homogeniety plot is the one in the third row(std residual or y axis) vs the Second column(predicted or x axis). The band shaped pattern as well as printed statistics confirm that all is well.



A plot of the cell means is given for completeness even though the interaction is not significant in the coarse table. We know however from our fine analysis based on apriori contrasts that there are significant components to this interaction.