EDRS 811
HW #4

Factorial ANOVA
Part I—Using SPSS
Use the data file memory.sav to examine the memorization data where 4 different experimental interventions and a control were used to examine memorization technique and word recall. Answer each of the following questions. Include any relevant output from SPSS.

A. **How many factors are there? How many levels in each? How would you describe the factorial ANOVA?**

There are two factors (levels): Method (5) and Age (2) resulting in a 5 x 2 factorial ANOVA

Erin Peters-Burton 12/5/2015 5:00 PM
Comment [1]: Good

- Method
  1. Counting
  2. Rhyming
  3. Adjective
  4. Imagery
  5. Control-Intentional
- Age
  1. Older
  2. Younger

B. **What are the main effects that will be tested?**
The unique effects of the different levels of Method averaged for Age and the unique effects of Age averaged for Method

What possible interactions do you expect to find?
The combined effects of each Method and older age, and each method and younger age

C. **Run the analyses in SPSS. Be sure to examine the homogeneity of variance assumption.**
Outliers removed: case 36

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

Dependent Variable: recall

F	df1	df2	Sig.
1.484	9	89	.166

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

a. Design: Intercept + method + age + method * age

D. What are the column and row means?

2. method

Dependent Variable: recall

method	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Counting	6.750	.590	5.577	7.923
Rhyming	7.250	.590	6.077	8.423
Adjective	12.900	.590	11.727	14.073
Imagery	14.967	.606	13.762	16.171
Control-Intentional	15.650	.590	14.477	16.823

3. age

Dependent Variable: recall

age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
older	9.847	.377	9.097	10.596
younger	13.160	.373	12.418	13.902

The grand mean?

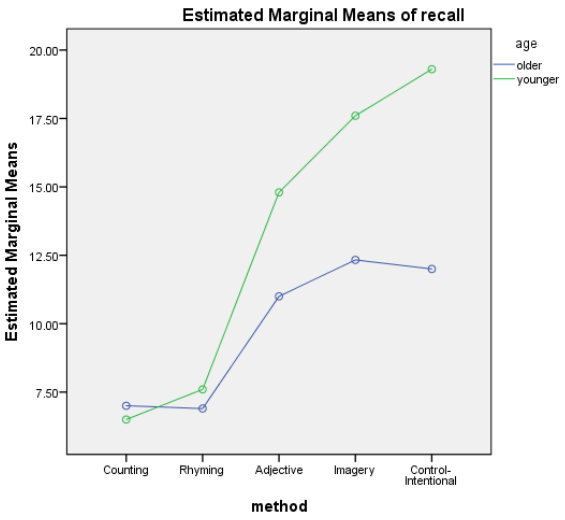
1. Grand Mean

Dependent Variable: recall

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
11.503	.265	10.976	12.031

Erin Peters-Burton 12/5/2015 5:01 PM
Comment [2]: Yay!

E. Make a graph (using either SPSS or excel) to help interpret your findings.



F. Test the following simple effect: Is there a significant difference between age groups in the control condition?

The older (*M* = 12.0000, *SD* = 3.74166) and younger (*M* = 19.3000, *SD* = 2.66875) groups were found to be significantly different (*p* =.0000)

G. What does the structural model look like for any member of the "old / imagery" group? What is the residual for the person in this group with a score of 16?

Mean of Old/Imagery = 12.333
Mean of Old = 9.7959
Mean of Imagery = 15.1053
Grand Mean μ= 11.503
Effect of Old $\boldsymbol{\alpha} =$ 9.7959-11.503
Effect of Imagery$\boldsymbol{\beta} =$ 15.1053-11.503
Interaction effect of Old/Imagery $(\alpha\beta)_{jk} = 12.333 - (9.7959 + 15.1053 - 11.318)\big]$

Observed score = 11.503 + (9.7959-11.503) + (15.1053-11.503) + [12.3333 - (9.7959+15.1053 -11.503)] + residual error

Residual = 16-11.503 = 4.497

A factorial ANOVA was conducted to determine if the mean recall scores of participants differed based upon four interventions and a control group (counting, rhyming, adjective, imagery, and control-intentional), and age (older or younger). The assumption of normality was tested and met via examination of the residuals. Review of the S-W test for normality ($SW = .979$, $df = 99$, $p = .125$) and skewness (.312) and kurtosis (.663) statistics suggested that normality was a reasonable assumption. The boxplot suggested a relatively normal distributional shape with one outlier (participant 44). The Q-Q plot suggested normality was reasonable. According to Levene's test, the homogeneity of variance assumption was satisfied [$F(9, 89) = 1.484$, $p = .166$). Random assignment of individuals to treatment groups helped ensure that the assumption of independence was met. Additionally, scatterplots of residuals against the levels of the independent variables were reviewed. A random display of points around 0 provided further evidence that the assumption of independence was met.

From the attached table we see that the interaction of treatment and age is statistically significant ($F_{method * age} = 7.378$, $df = 4$, $p = .000$). Additionally there are statistically significant main effects for both methods and age ($F_{method} = 51.102$, $df = 4$, $p = .000$; $F_{age} = 38.971$, $df = 1$, $p = .000$). Effect sizes are large for methods, age, and the interaction of methods and age (partial $\eta^2_{method} = .697$, partial $\eta^2_{age} = .305$, partial $\eta^2_{method*age} = .249$), and observed power for method, age, and the interaction of methods and age are near maximal ($\geq .995$)

Post hoc analyses were conducted given the statistically significant omnibus ANOVA F tests. The profile plot summarizes these differences. Tukey HSD tests were conducted on all possible pairwise contrasts. The following pairs of groups were found to be significantly different ($p < .05$):

- Counting ($M = 6.7500$, $SD = 1.61815$) and adjective ($M = 12.9000$, $SD = 5.53777$);
- Counting and imagery ($M = 15.1053$, $SD = 3.88580$);
- Counting and control-intentional ($M = 15.6500$, $SD = 4.90193$);
- Rhyming ($M = 7.2500$, $SD = 2.02290$) and adjective;
- Rhyming and imagery;
- Rhyming and control-intentional;
- Adjective and control-intentional.

In other words, participants in the counting treatment scored significantly lower than participants in the adjective, imagery, and control groups; participants in the rhyming group scored significantly lower than those in the adjective, imagery, and control-intentional groups; and those in the adjective group scored significantly lower than those in the control-intentional group.

For the main effect of the age of participants, an independent-t test revealed that those in the older group ($M = 7.000$, $SD = 1.82574$) had statistically higher recall scores that those in the younger group ($M = 6.5000$, $SD = 1.43372$).

Erin Peters-Burton 12/5/2015 5:01 PM
Comment [3]: Woo! Knocked it out of the park!!

ANCOVA

Use the data set hw5data_1.sav for the following analyses.

Company XYZ has implemented 5 different treatments in order to attempt to reduce the amount of minutes that employees spend on Facebook each workday. Analyze the data to determine if there are significant differences between the treatment methods.

Follow these steps:

- **Analyze the data to determine if there are treatment differences.**

  A one-way ANOVA was conducted to determine if the mean number of minutes that employees spend on Facebook each workday differed on 5 different treatments. The assumption of normality was tested and met via examination of the residuals. Review of the K-S test for normality (*K-S* = .061, *df* = 44, *p* = .200) and skewness (.273) and kurtosis (-.240) statistics suggested that normality was a reasonable assumption. The boxplot suggested a relatively normal distributional shape (2 outliers were removed) of the residuals. The Q-Q plot suggested normality was reasonable. According to Levene's test, the homogeneity of variance assumption was not satisfied [*F*(4, 39) = 3.665, *p* = .013). Random assignment of individuals to groups helped ensure that the assumption of independence was met. Additionally, a scatterplot of residuals against the levels of the independent variable was reviewed. A random display of points around 0 provided further evidence that the assumption of independence was met.

  A Welch ANOVA indicated that there was no statistically significant difference in the means of the treatments (*W* (4, 18.048) = 2.557, *p* = .074).

- **Next, determine if job satisfaction would be an appropriate covariate to include in the analysis. Be sure to test assumptions.**
  Attached tests
- **Run the ANCOVA analyses and explain your findings using APA format**

An ANCOVA was conducted to determine if the mean number of minutes on Facebook differed based on five different treatments, while controlling for the level of job satisfaction for the employees of XYZ Company. Independence of observations was met by random assignment of employees to treatments. This assumption was also confirmed by review of a scatterplot of residuals against the levels of treatment. A random display of points around 0 provided further evidence that the assumption of independence was met. According to Levene's test, the homogeneity of variance assumption was satisfied [*F* (4, 39) = .990, *p* = .424). The assumption of normality was tested and met via examination of the residuals. Review of the S-W test for normality (*SW* = .978, *df* = 44, *p* = .542) and skewness (.143) and kurtosis (1.042) statistics suggested that normality was a reasonable assumption. The boxplot suggested a relatively normal distributional shape with one outlier. The Q-Q plot suggested normality was reasonable. In general, there is evidence that normality has been met. Linearity of the dependent variable with the

covariate was examined with scatterplots, both overall and by group of the independent variable with the covariate suggested a negative linear relationship. This same pattern was present for the scatterplot of the dependent variable with the covariate when disaggregated by the categories of the independent variables. Independence of the covariate and independent variable was met by random assignment of employees to treatment method. This assumption was also confirmed by the one-way ANOVA which examined the mean difference on the covariate (job satisfaction) by the independent variable (treatment). The results were not statistically significant, $F = 2.198$, $p = .087$, which further confirms evidence of independence of the covariate and independent variable. Homogeneity of regression slopes was suggested by similar regression lines evidenced in the scatterplots of the dependent variable and covariates by group (reported earlier as evidence for linearity). This assumption was confirmed by a nonstatistically significant interaction of job satisfaction by treatment group, $F(4, 34) = .977$, $p = .433$.

The results of the ANCOVA suggest a statistically significant effect of the covariate, job satisfaction, on the dependent variable, time on Facebook ($F_{job\ satisfaction} = 60.357$; $df = 1, 38$; $p = .000$). More importantly there is a statistically significant effect for the treatment method ($F_{method} = 3.442$; $df = 4, 38$; $p = .017$), with a large effect size and strong power (partial $\eta^2_{method} = .266$, observed power - .808). The effect size suggests that about 26% of the variance in number of minutes on Facebook by employees can be accounted for by treatment method when controlling for job satisfaction.

Follow-up tests were conducted to evaluate the pairwise differences among the adjust means of Facebook minutes based on treatment method. The Bonferroni method was applied to control for the risk of increased Type I error across all pairwise comparisons. Treatment 2 ($M = 42.1625$, $SD = 27.12205$) was found to be significantly different ($p < .05$) from Treatment 3 ($M = 59.5875$, $SD = 18.73983$. In other words the mean number of minutes a participant spent on Facebook was significantly larger in Treatment 3 than in Treatment 2.

Also, answer the following questions:

1 What is the total sums of squares (SS type III column)?
Type I corrected = 14903.404

How is this number partitioned in the one-way ANOVA (24418.305) **(between and within) versus the ANCOVA? [Hint: What numbers add up to the total SS in each analysis?]** between/within/ look at notes

ANOVA:
SS total = SS between + SS within
14903.404 = 2906.996 + 11996.409

ANCOVA

SS corrected = SS treatment + SS error + SS job satisfaction
14903.404 = 1830.082 + 5050.871 + 8022.451

2 Examine the treatment group means for the ANOVA and the adjusted means for the ANCOVA.

ANOVA:

ANCOVA:

What similarities/differences are there?
Dif ANOVA – ANCOVA
Treatment 1 37.3000 – 46.205 = -8.905
Treatment 2 42.1625 – 38.090 = 4.0725
Treatment 3 59.5875 – 57.688 = 1.8995
Treatment 4 50.4500 – 42.175 = 8.275
Treatment 5 39.4300 – 41.939 = -2.59

Treatments 3 and 5 showed the least change, treatments 1 and 4 the most.

Is there any change to rank order?
ANOVA: 1, 5, 4, 2, 3
ANCOVA: 2, 4, 5, 1, 3
Treatments 1-5 changed direction (1, 5, 4, 2 to 2, 4, 5, 1). Treatment 3 remained at the bottom.

Treatment 3 stability is pretty interesting here. It is the greatest number of minutes, which did not change when controlling for job satisfaction. Controlling for job satisfaction: Treatment 1 and 4 showed a much greater effect (lower number of minutes), treatment 1 effect was reduced from highest to second lowest (greater number of minutes).

Is there a test to describe the significance of these changes or do we just use the ANOVA to ANCOVA comparison?

Erin Peters-Burton 12/5/2015 5:02 PM
Comment [4]: Just the comparison – the differences in the F ratios tell us a lot!

EDRS 811
HW #4

Factorial ANOVA A

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Residual for recall	99	100.0%	0	0.0%	99	100.0%

Descriptives

			Statistic	Std. Error
Residual for recall	Mean		.0000	.25277
	95% Confidence Interval for Mean	Lower Bound	-.5016	
		Upper Bound	.5016	
	5% Trimmed Mean		-.0601	
	Median		-.3333	
	Variance		6.326	
	Std. Deviation		2.51506	
	Minimum		-7.00	
	Maximum		7.20	
	Range		14.20	

	Interquartile Range	3.60	
	Skewness	.312	.243
	Kurtosis	.663	.481

Extreme Values

			Case Number	Value
Residual for recall	Highest	1	76	7.20
		2	42	7.00
		3	39	6.67
		4	88	4.40
		5	16	4.10
	Lowest	1	44	-7.00
		2	24	-5.00
		3	94	-4.30
		4	18	-3.90
		5	80	-3.80[a]

a. Only a partial list of cases with the value -3.80 are shown in the table of lower extremes.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual for recall	.080	99	.120	.979	99	.125

a. Lilliefors Significance Correction

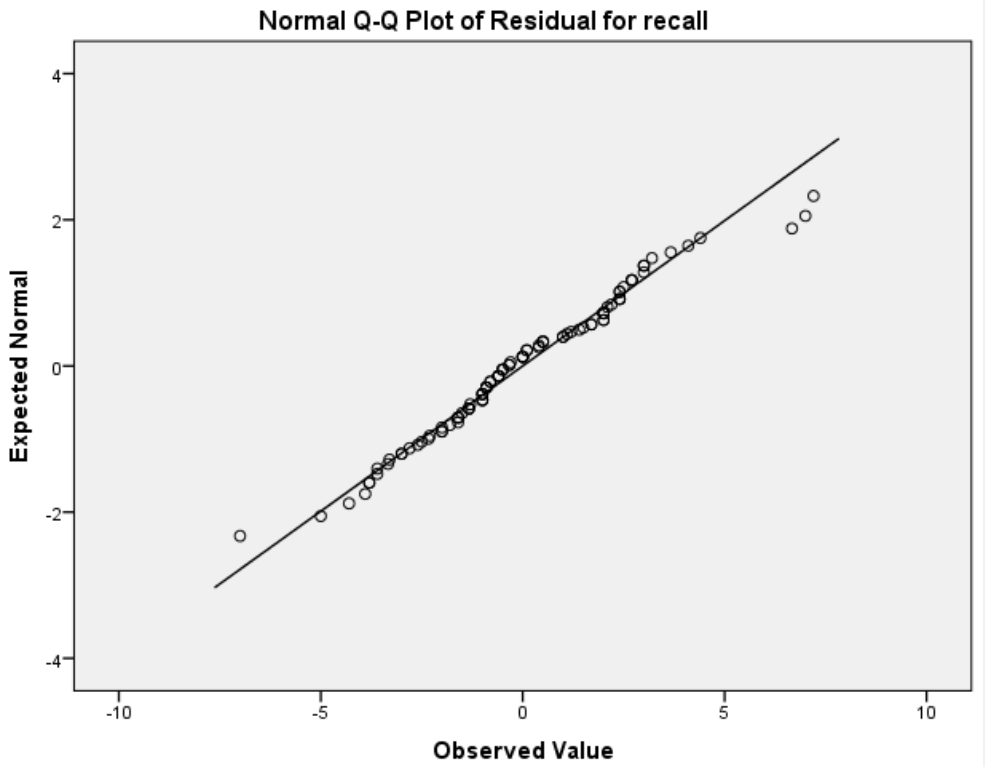
Residual for recall

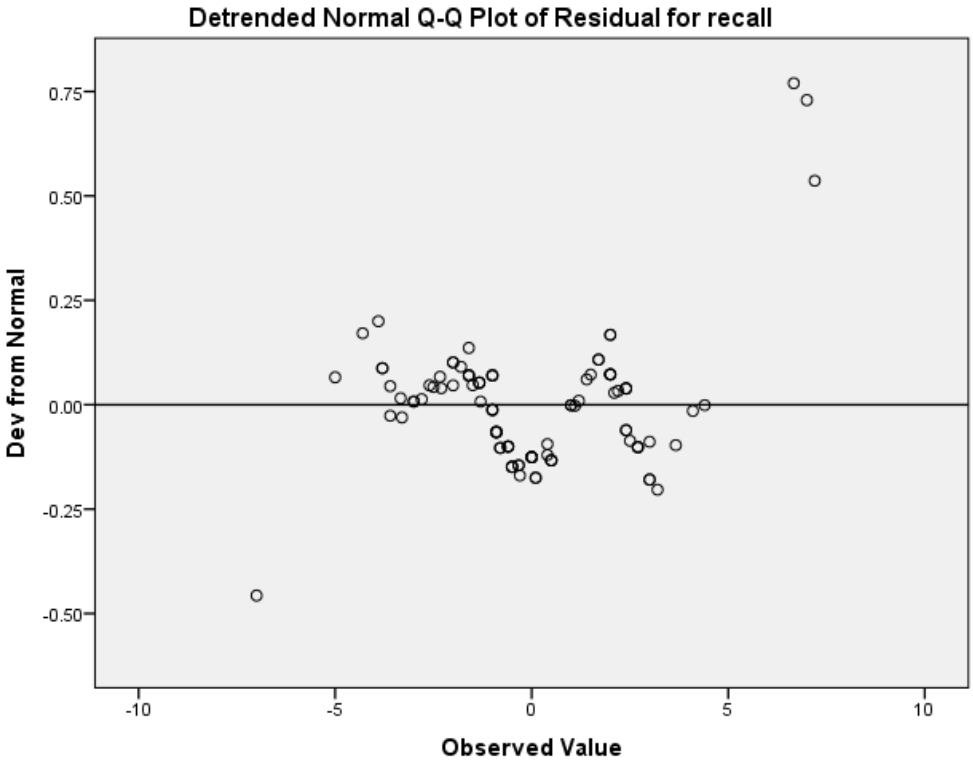
Residual for recall Stem-and-Leaf Plot

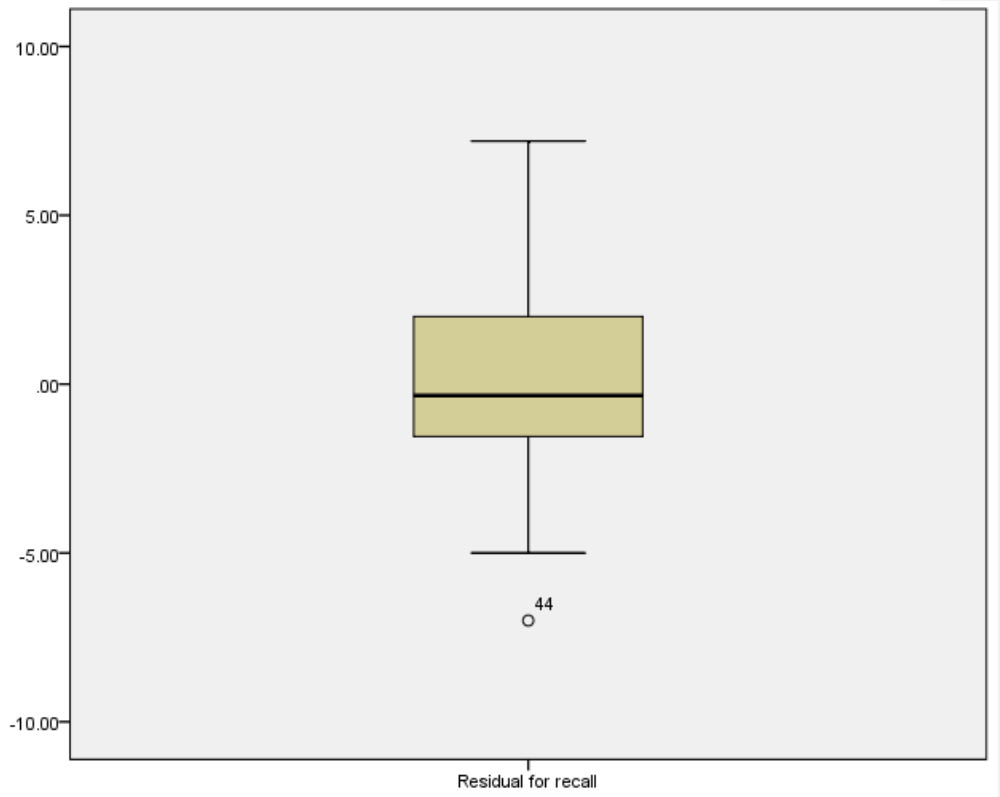
Frequency Stem & Leaf

```
 1.00 Extremes    (=<-7)
 2.00       -0 .  45
17.00       -0 .  22222222333333333
32.00       -0 .  00000000000000001111111111111111
20.00        0 .  00000000000011111111
22.00        0 .  2222222222222222233333
 2.00        0 .  44
 3.00        0 .  677

Stem width:     10.00
Each leaf:      1 case(s)
```




Detrended Normal Q-Q Plot of Residual for recall
Dev from Normal
0.75
0.50
0.25
0.00
-0.25
-0.50
-10
-5
0
5
10
Observed Value



Factorial ANOVA C

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
method	1.00	Counting	20
	2.00	Rhyming	20
	3.00	Adjective	20
	4.00	Imagery	19

	5.00	Control-Intentional	20
age	1.00	older	49
	2.00	younger	50

Descriptive Statistics

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Counting	older	7.0000	1.82574	10
	younger	6.5000	1.43372	10
	Total	6.7500	1.61815	20
Rhyming	older	6.9000	2.13177	10
	younger	7.6000	1.95505	10
	Total	7.2500	2.02290	20
Adjective	older	11.0000	2.49444	10
	younger	14.8000	3.48967	10
	Total	12.9000	3.53777	20
Imagery	older	12.3333	3.16228	9
	younger	17.6000	2.59058	10
	Total	15.1053	3.88580	19
Control-Intentional	older	12.0000	3.74166	10
	younger	19.3000	2.66875	10
	Total	15.6500	4.90193	20
Total	older	9.7959	3.58225	49
	younger	13.1600	5.78654	50
	Total	11.4949	5.08775	99

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

Dependent Variable: recall

F	df1	df2	Sig.
1.484	9	89	.166

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

a. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	1916.847[a]	9	212.983	30.578	.000	.756	275.205	1.000
Intercept	13087.254	1	13087.254	1878.957	.000	.955	1878.957	1.000
method	1423.744	4	355.936	51.102	.000	.697	204.409	1.000
age	271.438	1	271.438	38.971	.000	.305	38.971	1.000
method * age	205.570	4	51.392	7.378	.000	.249	29.514	.995
Error	619.900	89	6.965					
Total	15618.000	99						
Corrected Total	2536.747	98						

a. R Squared = .756 (Adjusted R Squared = .731)

b. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean

Dependent Variable: recall

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
11.503	.265	10.976	12.031

2. method

Dependent Variable: recall

method	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Counting	6.750	.590	5.577	7.923
Rhyming	7.250	.590	6.077	8.423

Adjective	12.900	.590	11.727	14.073
Imagery	14.967	.606	13.762	16.171
Control-Intentional	15.650	.590	14.477	16.823

3. age

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	9.847	.377	9.097	10.596
younger	13.160	.373	12.418	13.902

4. method * age

Dependent Variable: recall

				95% Confidence Interval	
method	age	Mean	Std. Error	Lower Bound	Upper Bound
Counting	older	7.000	.835	5.342	8.658
	younger	6.500	.835	4.842	8.158
Rhyming	older	6.900	.835	5.242	8.558
	younger	7.600	.835	5.942	9.258
Adjective	older	11.000	.835	9.342	12.658
	younger	14.800	.835	13.142	16.458
Imagery	older	12.333	.880	10.585	14.081
	younger	17.600	.835	15.942	19.258
Control-Intentional	older	12.000	.835	10.342	13.658
	younger	19.300	.835	17.642	20.958

Post Hoc Tests

method

Multiple Comparisons

Dependent Variable: recall

Tukey HSD

(I) method	(J) method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Counting	Rhyming	-.5000	.83458	.975	-2.8239	1.8239
	Adjective	-6.1500*	.83458	.000	-8.4739	-3.8261
	Imagery	-8.3553*	.84549	.000	-10.7095	-6.0010
	Control-Intentional	-8.9000*	.83458	.000	-11.2239	-6.5761
Rhyming	Counting	.5000	.83458	.975	-1.8239	2.8239
	Adjective	-5.6500*	.83458	.000	-7.9739	-3.3261
	Imagery	-7.8553*	.84549	.000	-10.2095	-5.5010
	Control-Intentional	-8.4000*	.83458	.000	-10.7239	-6.0761
Adjective	Counting	6.1500*	.83458	.000	3.8261	8.4739
	Rhyming	5.6500*	.83458	.000	3.3261	7.9739
	Imagery	-2.2053	.84549	.077	-4.5595	.1490
	Control-Intentional	-2.7500*	.83458	.012	-5.0739	-.4261
Imagery	Counting	8.3553*	.84549	.000	6.0010	10.7095
	Rhyming	7.8553*	.84549	.000	5.5010	10.2095
	Adjective	2.2053	.84549	.077	-.1490	4.5595
	Control-Intentional	-.5447	.84549	.967	-2.8990	1.8095
Control-Intentional	Counting	8.9000*	.83458	.000	6.5761	11.2239
	Rhyming	8.4000*	.83458	.000	6.0761	10.7239
	Adjective	2.7500*	.83458	.012	.4261	5.0739
	Imagery	.5447	.84549	.967	-1.8095	2.8990

Based on observed means.

The error term is Mean Square(Error) = 6.965.

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

recall

Tukey HSD[a,b,c]

method	N	Subset 1	Subset 2	Subset 3
Counting	20	6.7500		
Rhyming	20	7.2500		
Adjective	20		12.9000	
Imagery	19		15.1053	15.1053
Control-Intentional	20			15.6500
Sig.		.975	.074	.966

Means for groups in homogeneous subsets are displayed.

Based on observed means.

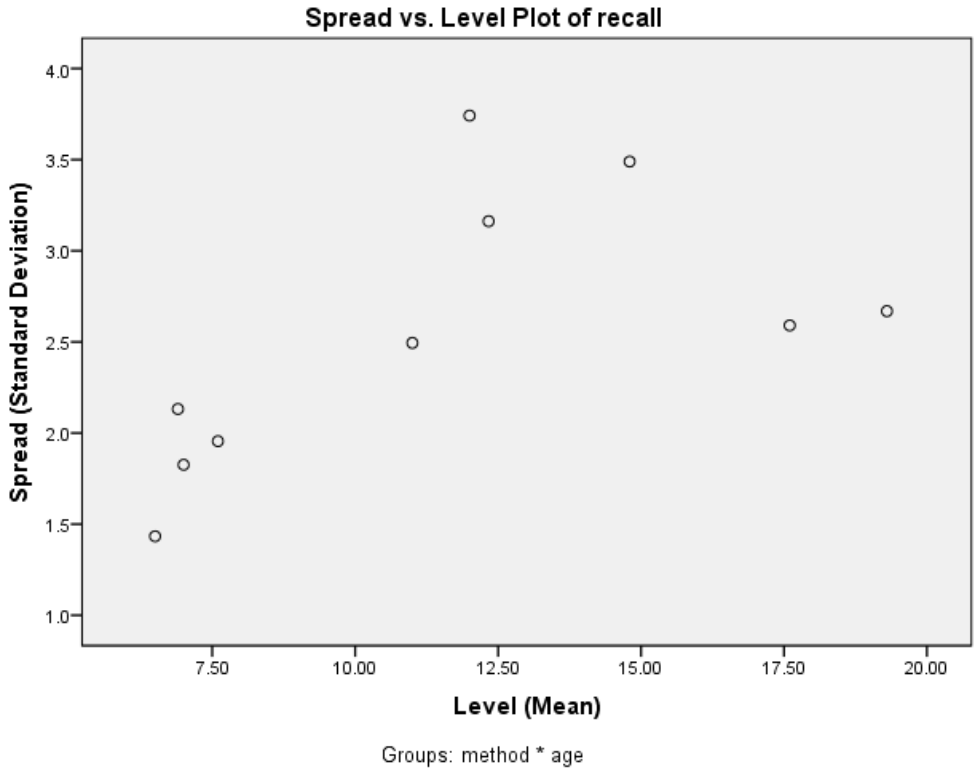
The error term is Mean Square(Error) = 6.965.

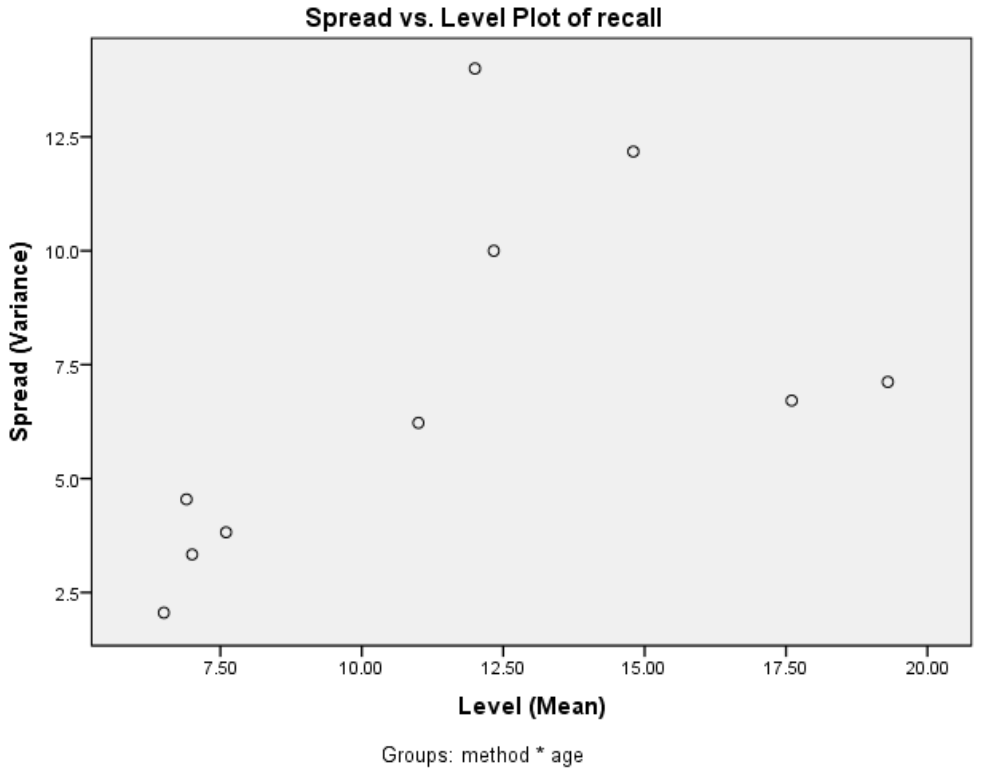
a. Uses Harmonic Mean Sample Size = 19.792.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

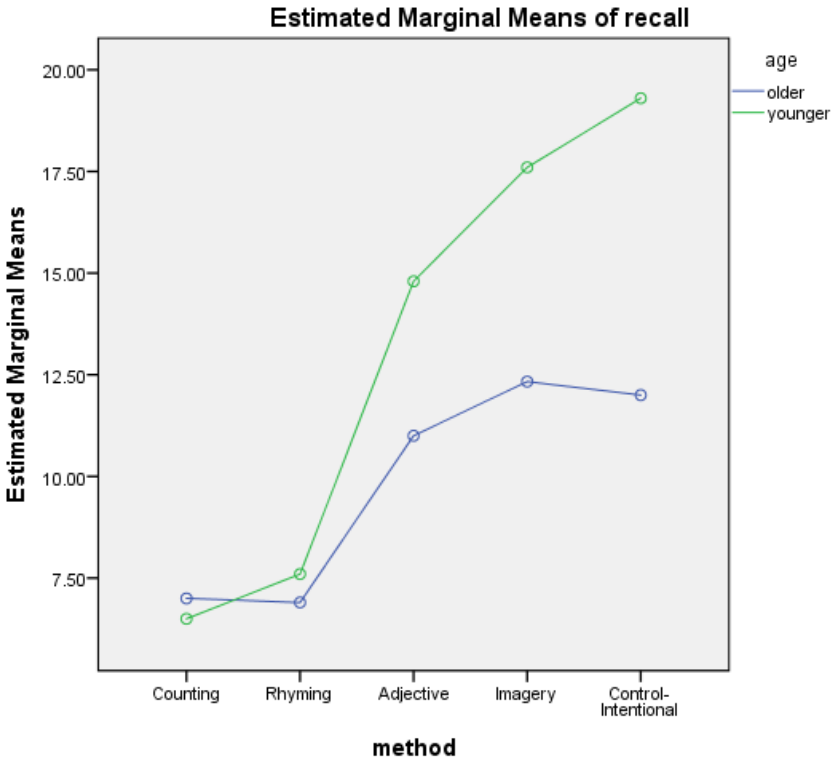
c. Alpha = .05.

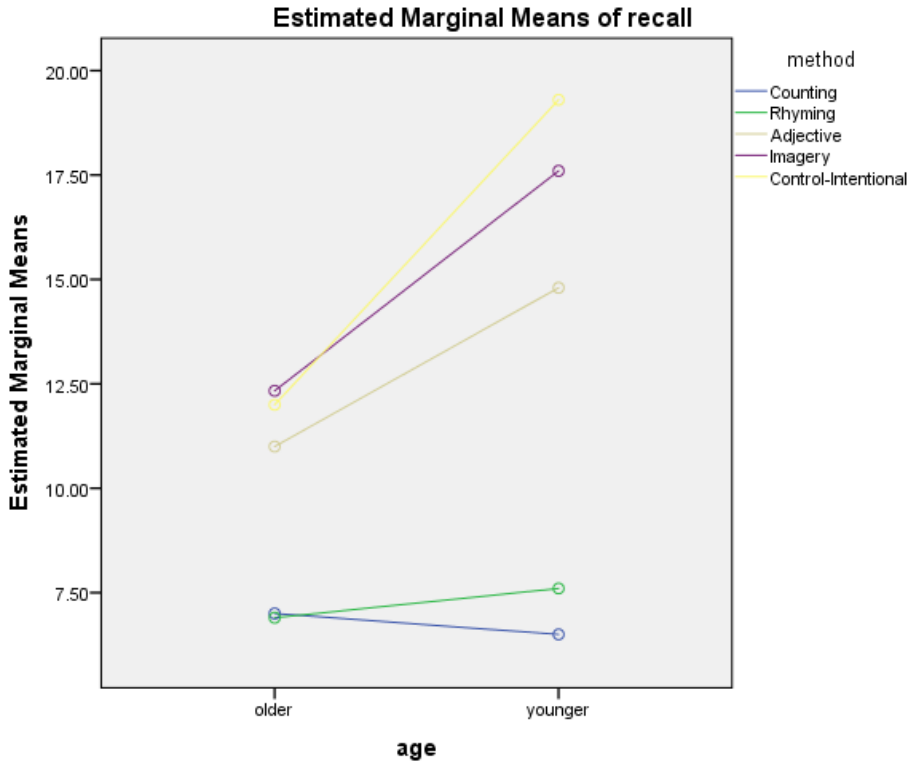
Spread-versus-Level Plots


Spread vs. Level Plot of recall
Spread (Standard Deviation)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
7.50
10.00
12.50
15.00
17.50
20.00
Level (Mean)
Groups: method * age



Profile Plots


Estimated Marginal Means of recall
Estimated Marginal Means
20.00
17.50
15.00
12.50
10.00
7.50
Counting
Rhyming
Adjective
Imagery
Control-Intentional
method
age
older
younger



Factorial ANOVA F:

Oneway

method = Control-Intentional

Between-Subjects Factors[a]

		Value Label	N
method	5.00	Control-Intentional	20
age	1.00	older	10

2.00	younger	10

a. method = Control-Intentional

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Control-Intentional	older	12.0000	3.74166	10
	younger	19.3000	2.66875	10
	Total	15.6500	4.90193	20
Total	older	12.0000	3.74166	10
	younger	19.3000	2.66875	10
	Total	15.6500	4.90193	20

a. method = Control-Intentional

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

Dependent Variable: recall

F	df1	df2	Sig.
.383	1	18	.544

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

a. method = Control-Intentional

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	266.450[b]	1	266.450	25.229	.000	.584	25.229	.997
Intercept	4898.450	1	4898.450	463.820	.000	.963	463.820	1.000
method	.000	0	.	.	.	.000	.000	.
age	266.450	1	266.450	25.229	.000	.584	25.229	.997
method * age	.000	0	.	.	.	.000	.000	.

Error	190.100	18	10.561					
Total	5355.000	20						
Corrected Total	456.550	19						

a. method = Control-Intentional

b. R Squared = .584 (Adjusted R Squared = .560)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

		95% Confidence Interval	
Mean	Std. Error	Lower Bound	Upper Bound
15.650	.727	14.123	17.177

a. method = Control-Intentional

2. method[a]

Dependent Variable: recall

			95% Confidence Interval	
method	Mean	Std. Error	Lower Bound	Upper Bound
Control-Intentional	15.650	.727	14.123	17.177

a. method = Control-Intentional

3. age[a]

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	12.000	1.028	9.841	14.159
younger	19.300	1.028	17.141	21.459

a. method = Control-Intentional

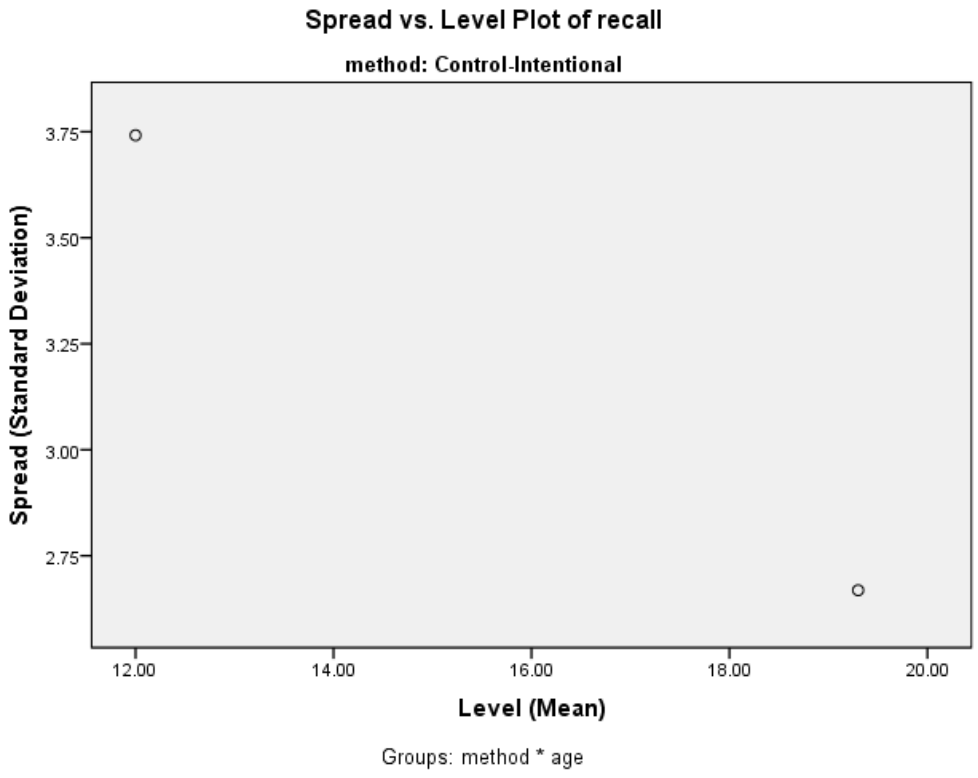
4. method * age[a]

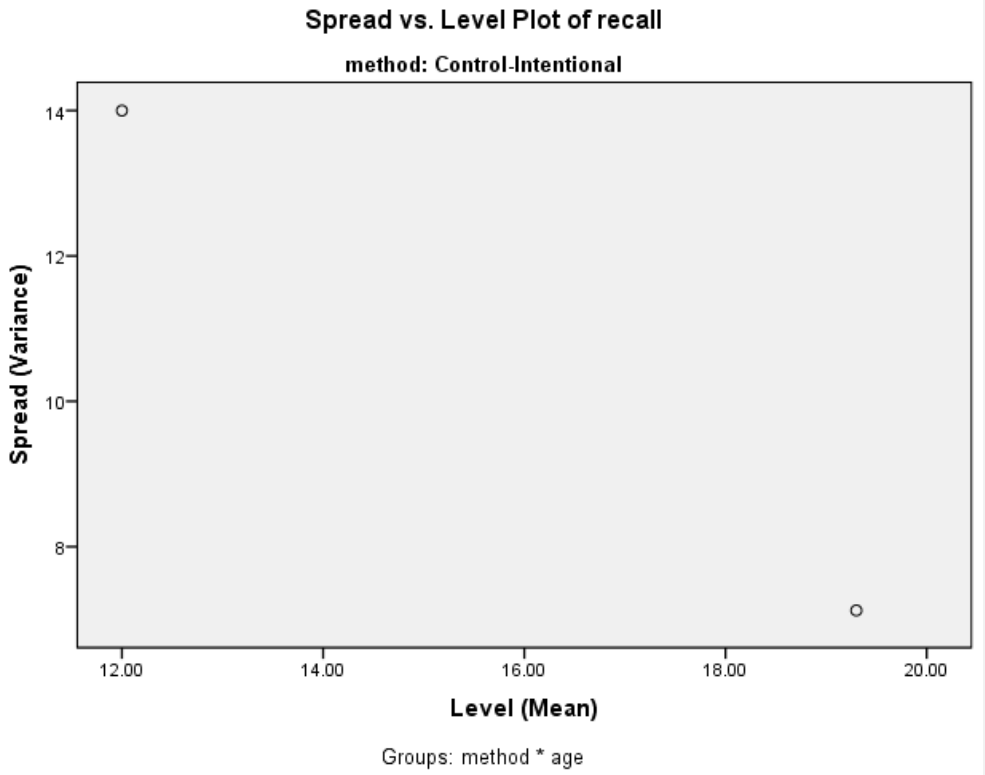
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control-Intentional	older	12.000	1.028	9.841	14.159
	younger	19.300	1.028	17.141	21.459

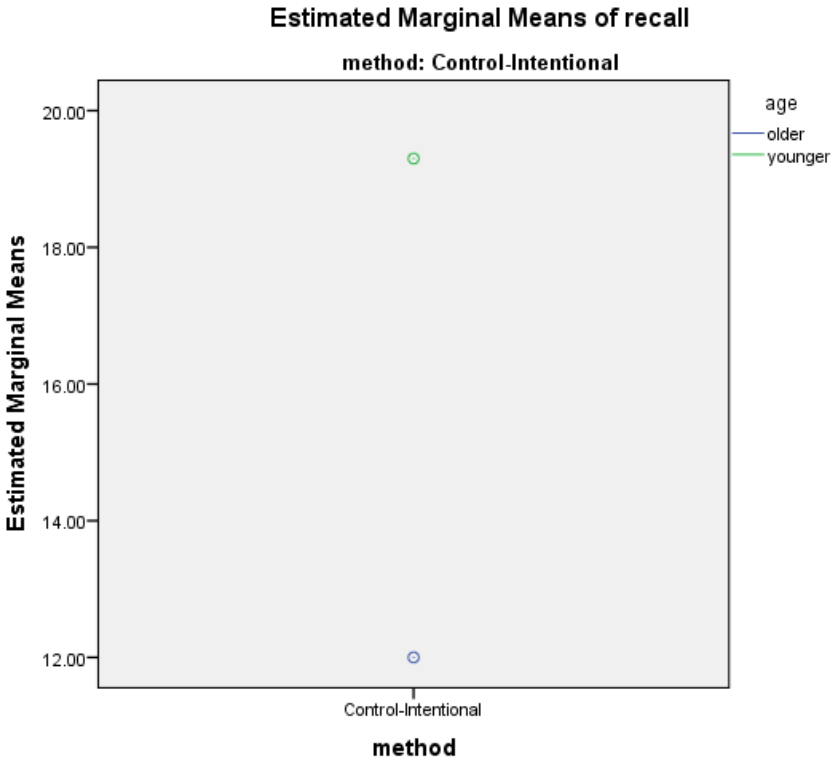
a. method = Control-Intentional

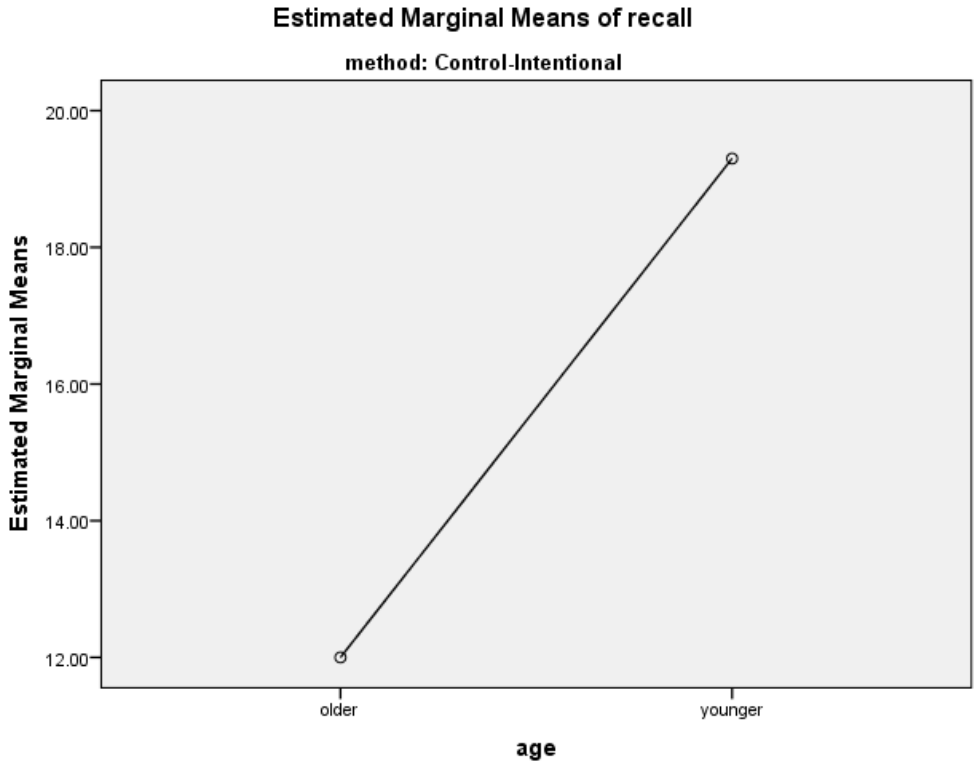
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Control-Intentional
Estimated Marginal Means
20.00
18.00
16.00
14.00
12.00
Control-Intentional
method
age
older
younger




```
SORT CASES  BY method.
SPLIT FILE SEPARATE BY method.
UNIANOVA recall BY method age
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /SAVE=RESID
  /POSTHOC=method age(TUKEY)
  /PLOT=PROFILE(method*age age*method)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(method)
  /EMMEANS=TABLES(age)
  /EMMEANS=TABLES(method*age)
  /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE
  /PLOT=SPREADLEVEL
  /CRITERIA=ALPHA(.05)
  /DESIGN=method age method*age.
```

Univariate Analysis of Variance

Notes

Output Created		02-DEC-2015 11:19:56
Comments		
Input	Data	C:\Users\kfair2\AppData\Local\Temp\memory(1).sav
	Active Dataset	DataSet1
	Filter	RES_1 < 9.6 (FILTER)
	Weight	<none>
	Split File	method
	N of Rows in Working Data File	99
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		UNIANOVA recall BY method age /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /SAVE=RESID /POSTHOC=method age(TUKEY) /PLOT=PROFILE(method*age age*method) /EMMEANS=TABLES(OVERALL) /EMMEANS=TABLES(method) /EMMEANS=TABLES(age) /EMMEANS=TABLES(method*age) /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE /PLOT=SPREADLEVEL /CRITERIA=ALPHA(.05) /DESIGN=method age method*age.
Resources	Processor Time	00:00:04.91
	Elapsed Time	00:00:03.97

Variables Created or Modified	RES_4	Residual for recall

Warnings

Post hoc tests are not performed for method in split file method=Counting because there are fewer than three groups.

Post hoc tests are not performed for age in split file method=Counting because there are fewer than three groups.

Post hoc tests are not performed for method in split file method=Rhyming because there are fewer than three groups.

Post hoc tests are not performed for age in split file method=Rhyming because there are fewer than three groups.

Post hoc tests are not performed for method in split file method=Adjective because there are fewer than three groups.

Post hoc tests are not performed for age in split file method=Adjective because there are fewer than three groups.

Post hoc tests are not performed for method in split file method=Imagery because there are fewer than three groups.

Post hoc tests are not performed for age in split file method=Imagery because there are fewer than three groups.

Post hoc tests are not performed for method in split file method=Control-Intentional because there are fewer than three groups.

Post hoc tests are not performed for age in split file method=Control-Intentional because there are fewer than three groups.

method = Counting

Between-Subjects Factors[a]

		Value Label	N
method	1.00	Counting	20
age	1.00	older	10
	2.00	younger	10

a. method = Counting

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Counting	older	7.0000	1.82574	10
	younger	6.5000	1.43372	10
	Total	6.7500	1.61815	20
Total	older	7.0000	1.82574	10
	younger	6.5000	1.43372	10
	Total	6.7500	1.61815	20

a. method = Counting

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

Dependent Variable: recall

F	df1	df2	Sig.
.482	1	18	.496

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

a. method = Counting

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	1.250[b]	1	1.250	.464	.504	.025	.464	.099
Intercept	911.250	1	911.250	338.196	.000	.949	338.196	1.000
method	.000	0	.	.	.	.000	.000	.
age	1.250	1	1.250	.464	.504	.025	.464	.099
method * age	.000	0	.	.	.	.000	.000	.
Error	48.500	18	2.694					
Total	961.000	20						

Corrected Total	49.750	19						

a. method = Counting

b. R Squared = .025 (Adjusted R Squared = -.029)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

		95% Confidence Interval	
Mean	Std. Error	Lower Bound	Upper Bound
6.750	.367	5.979	7.521

a. method = Counting

2. method[a]

Dependent Variable: recall

			95% Confidence Interval	
method	Mean	Std. Error	Lower Bound	Upper Bound
Counting	6.750	.367	5.979	7.521

a. method = Counting

3. age[a]

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	7.000	.519	5.909	8.091
younger	6.500	.519	5.409	7.591

a. method = Counting

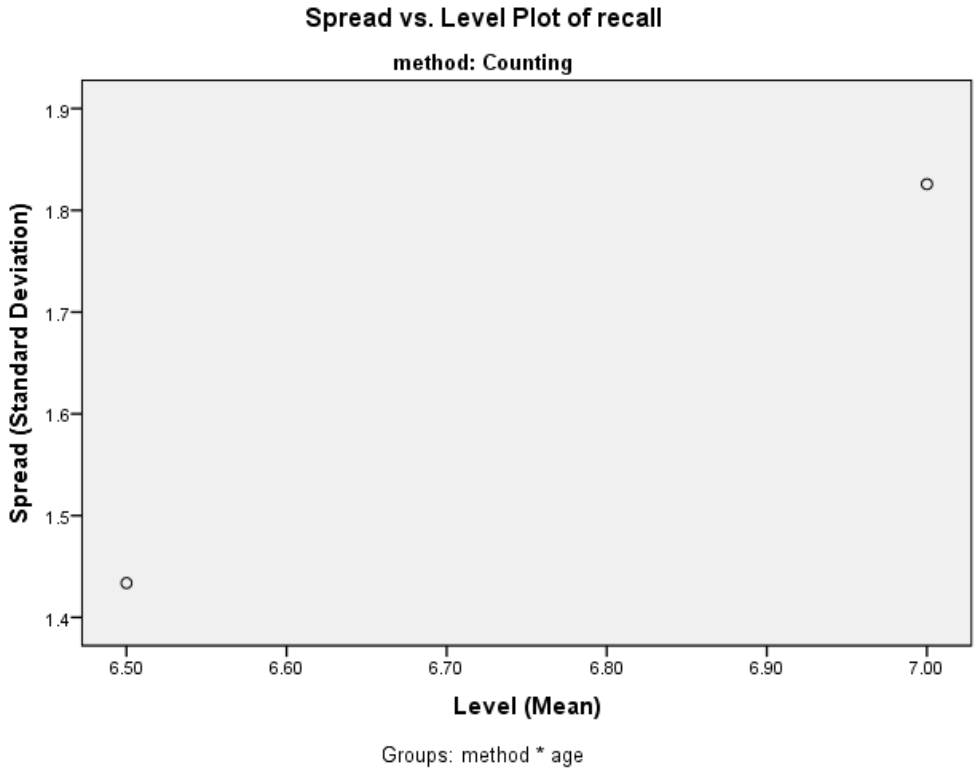
4. method * age[a]

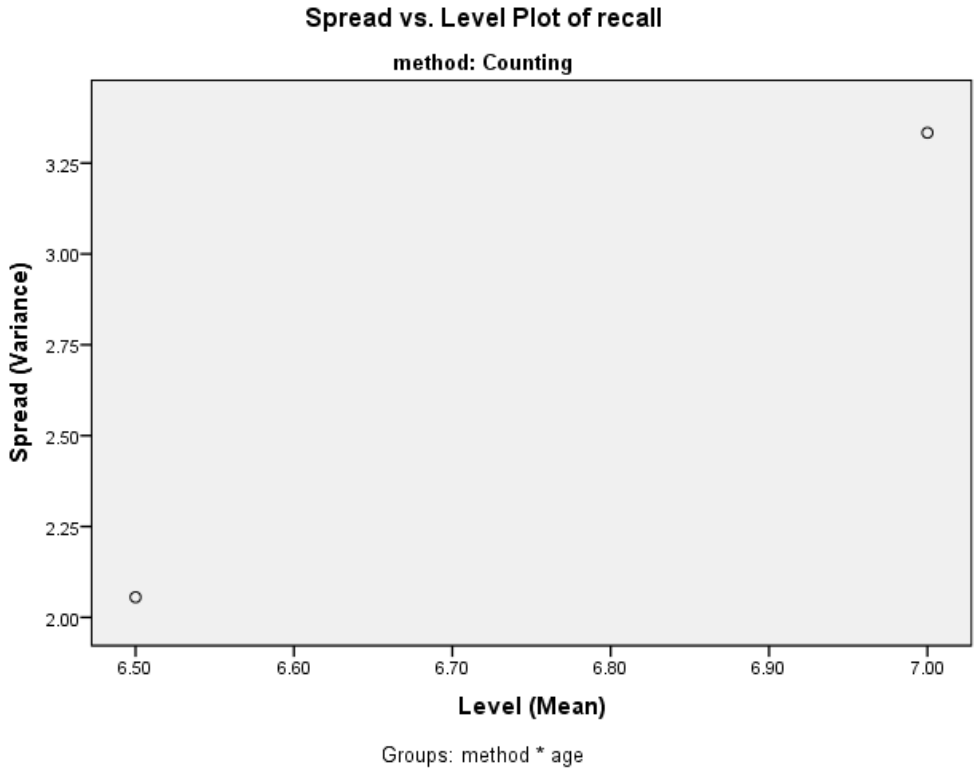
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Counting	older	7.000	.519	5.909	8.091
	younger	6.500	.519	5.409	7.591

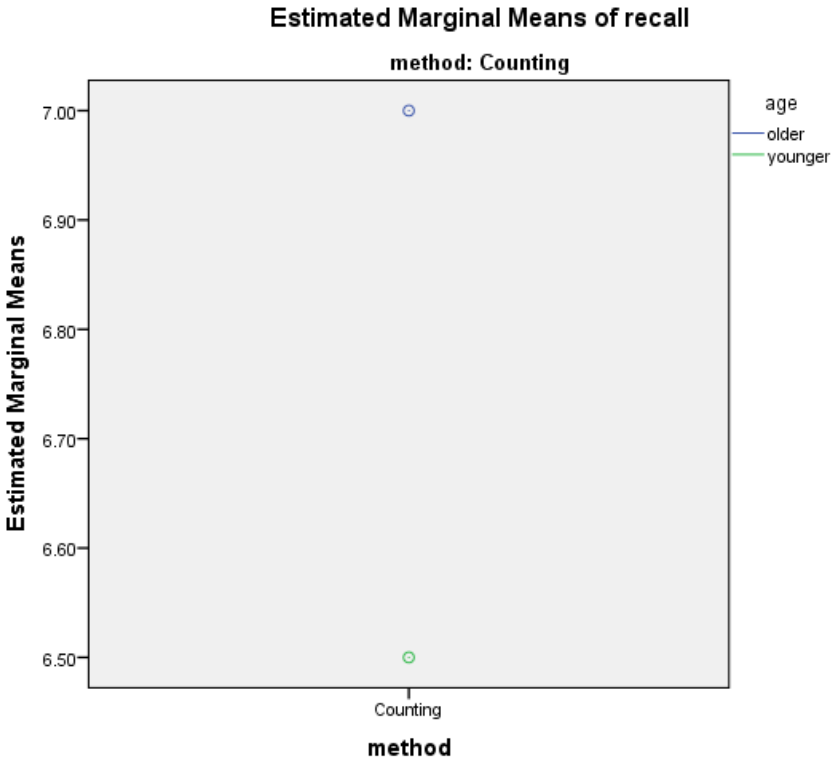
a. method = Counting

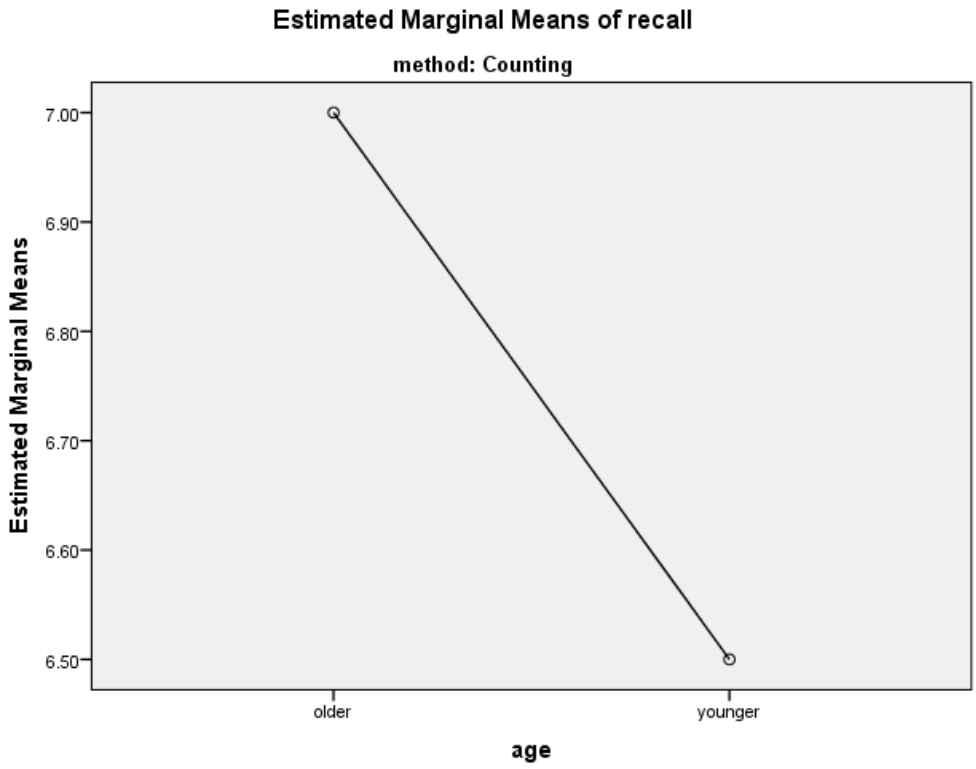
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Counting
Estimated Marginal Means
7.00
6.90
6.80
6.70
6.60
6.50
Counting
method
age
older
younger



method = Rhyming

Between-Subjects Factors[a]

		Value Label	N
method	2.00	Rhyming	20
age	1.00	older	10
	2.00	younger	10

a. method = Rhyming

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Rhyming	older	6.9000	2.13177	10
	younger	7.6000	1.95505	10
	Total	7.2500	2.02290	20
Total	older	6.9000	2.13177	10
	younger	7.6000	1.95505	10
	Total	7.2500	2.02290	20

a. method = Rhyming

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

Dependent Variable: recall

F	df1	df2	Sig.
.001	1	18	.973

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

a. method = Rhyming

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	2.450[b]	1	2.450	.586	.454	.032	.586	.112
Intercept	1051.250	1	1051.250	251.295	.000	.933	251.295	1.000
method	.000	0	.	.	.	.000	.000	.
age	2.450	1	2.450	.586	.454	.032	.586	.112
method * age	.000	0	.	.	.	.000	.000	.
Error	75.300	18	4.183					
Total	1129.000	20						
Corrected Total	77.750	19						

a. method = Rhyming

b. R Squared = .032 (Adjusted R Squared = -.022)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
7.250	.457	6.289	8.211

a. method = Rhyming

2. method[a]

Dependent Variable: recall

method	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Rhyming	7.250	.457	6.289	8.211

a. method = Rhyming

3. age[a]

Dependent Variable: recall

age	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
older	6.900	.647	5.541	8.259
younger	7.600	.647	6.241	8.959

a. method = Rhyming

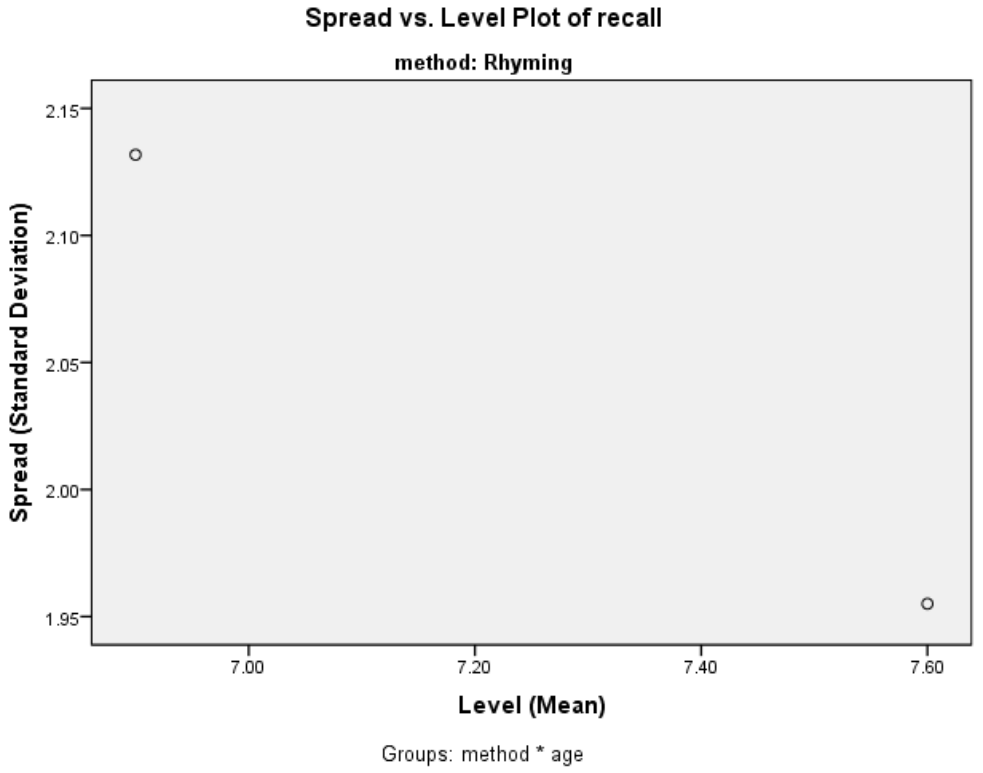
4. method * age[a]

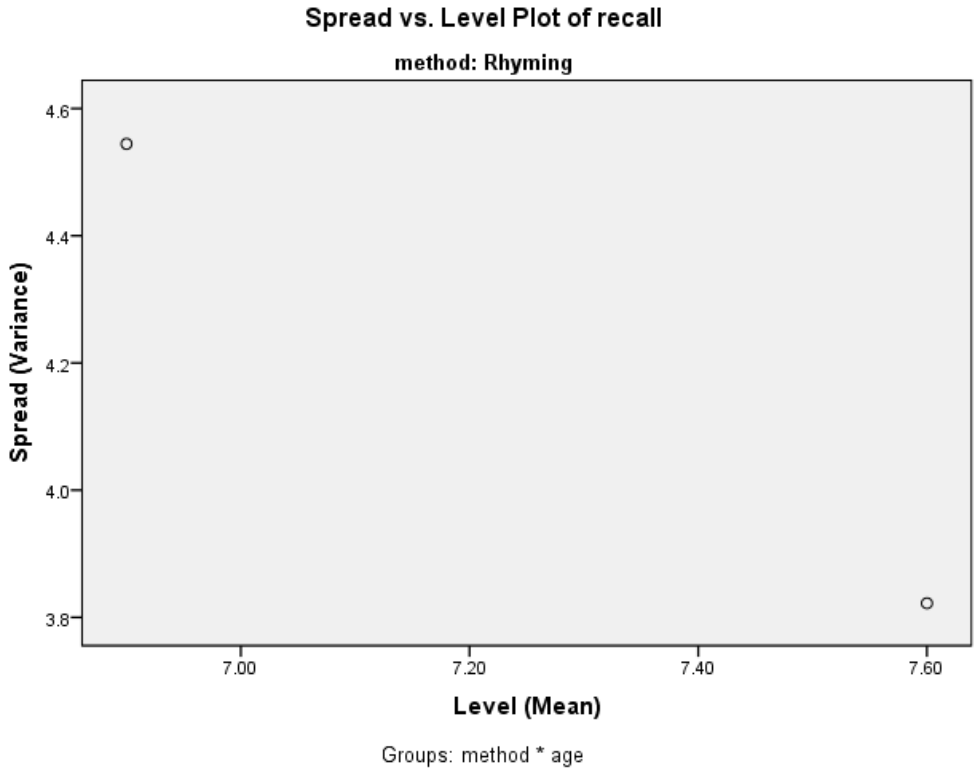
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Rhyming	older	6.900	.647	5.541	8.259
	younger	7.600	.647	6.241	8.959

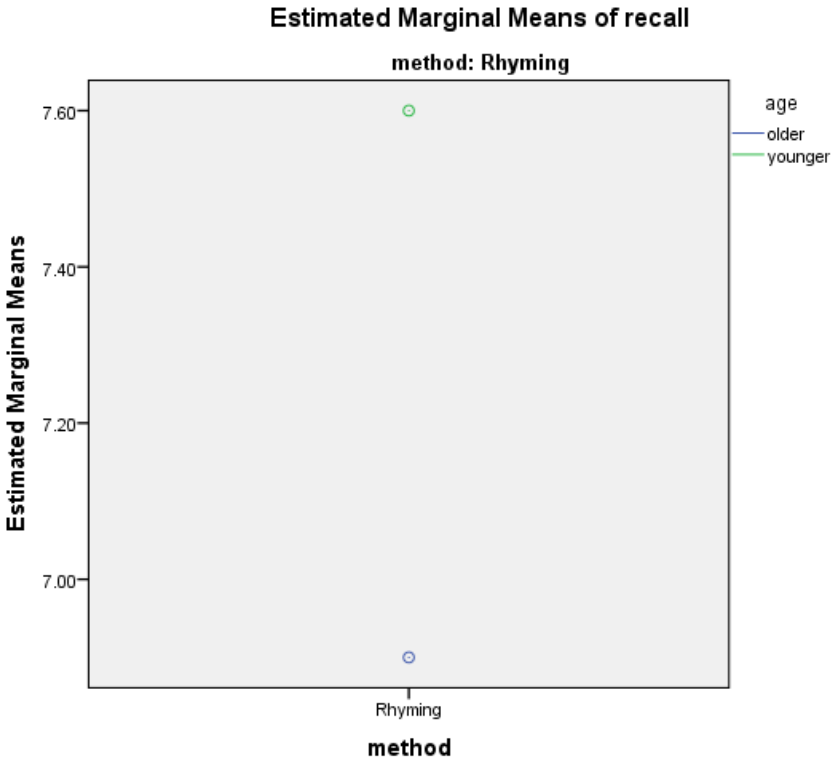
a. method = Rhyming

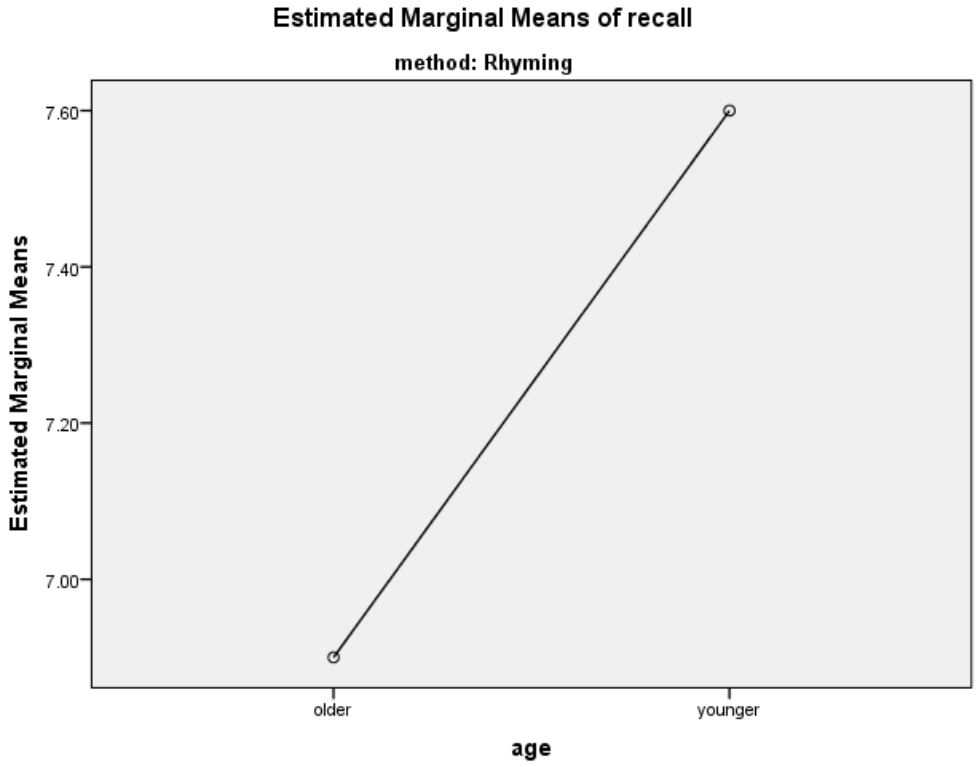
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Rhyming
Estimated Marginal Means
7.60
7.40
7.20
7.00
Rhyming
method
age
older
younger



method = Adjective

Between-Subjects Factors[a]

		Value Label	N
method	3.00	Adjective	20
age	1.00	older	10
	2.00	younger	10

a. method = Adjective

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Adjective	older	11.0000	2.49444	10
	younger	14.8000	3.48967	10
	Total	12.9000	3.53777	20
Total	older	11.0000	2.49444	10
	younger	14.8000	3.48967	10
	Total	12.9000	3.53777	20

a. method = Adjective

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

Dependent Variable: recall

F	df1	df2	Sig.
1.455	1	18	.243

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

a. method = Adjective

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	72.200[b]	1	72.200	7.848	.012	.304	7.848	.755
Intercept	3328.200	1	3328.200	361.761	.000	.953	361.761	1.000
method	.000	0	.	.	.	.000	.000	.
age	72.200	1	72.200	7.848	.012	.304	7.848	.755
method * age	.000	0	.	.	.	.000	.000	.
Error	165.600	18	9.200					
Total	3566.000	20						
Corrected Total	237.800	19						

a. method = Adjective

b. R Squared = .304 (Adjusted R Squared = .265)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

		95% Confidence Interval	
Mean	Std. Error	Lower Bound	Upper Bound
12.900	.678	11.475	14.325

a. method = Adjective

2. method[a]

Dependent Variable: recall

			95% Confidence Interval	
method	Mean	Std. Error	Lower Bound	Upper Bound
Adjective	12.900	.678	11.475	14.325

a. method = Adjective

3. age[a]

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	11.000	.959	8.985	13.015
younger	14.800	.959	12.785	16.815

a. method = Adjective

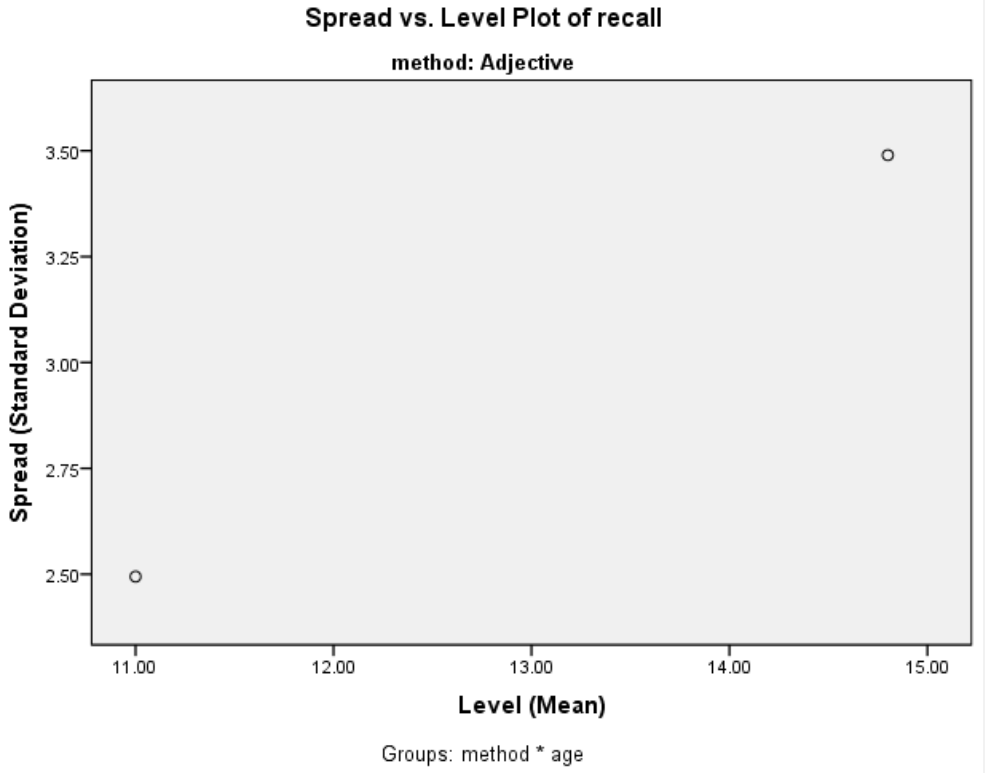
4. method * age[a]

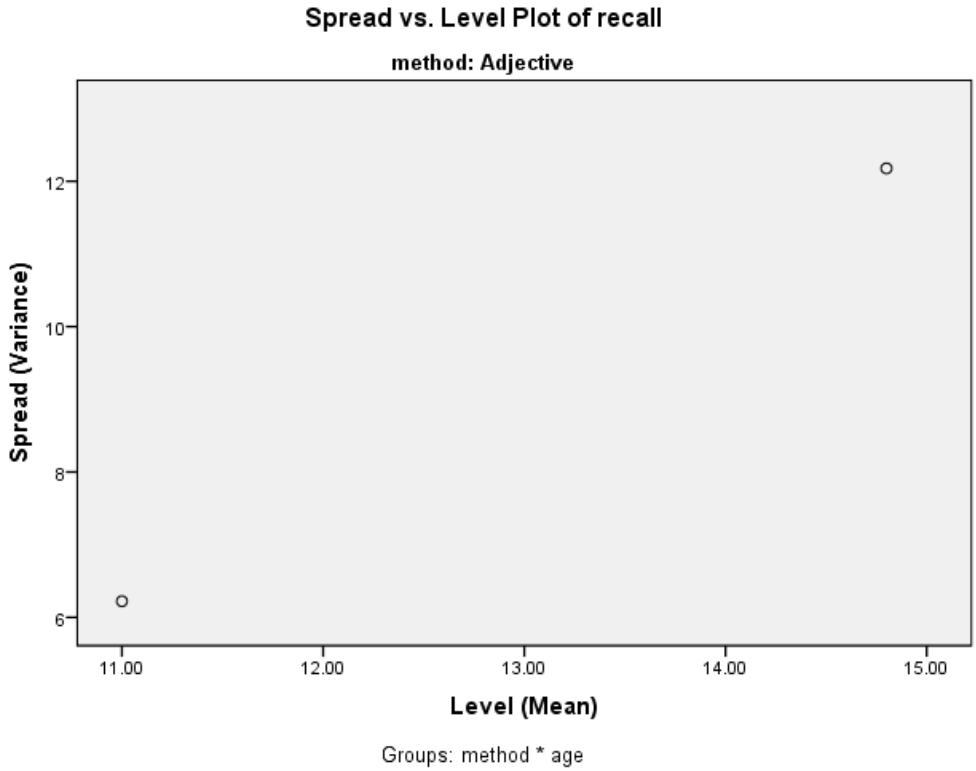
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Adjective	older	11.000	.959	8.985	13.015
	younger	14.800	.959	12.785	16.815

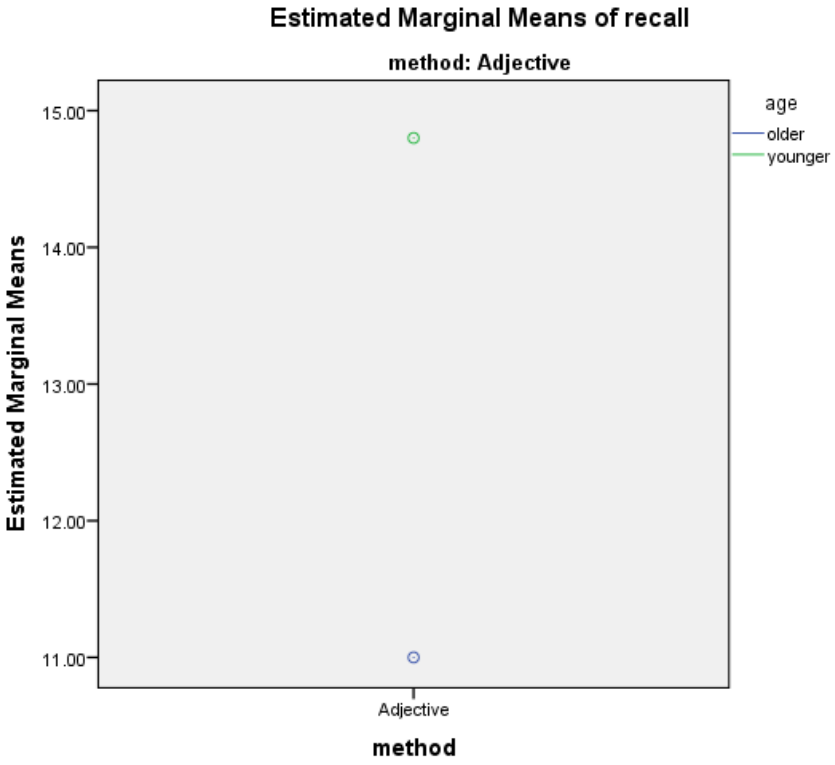
a. method = Adjective

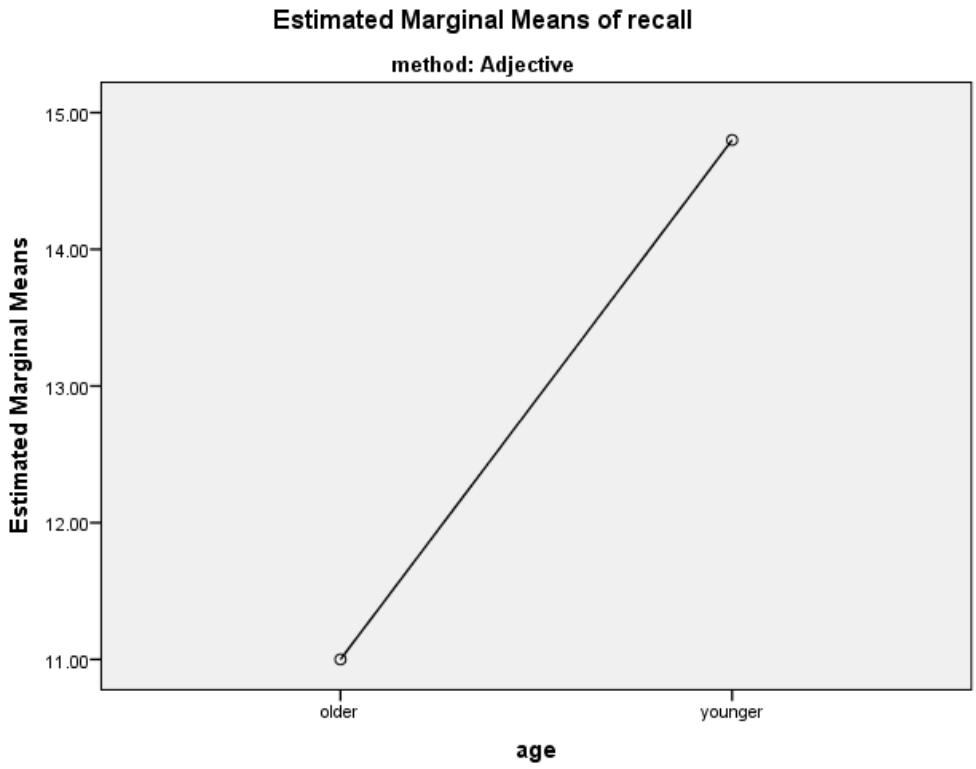
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Adjective
Estimated Marginal Means
15.00
14.00
13.00
12.00
11.00
Adjective
method
age
older
younger



method = Imagery

Between-Subjects Factors[a]

		Value Label	N
method	4.00	Imagery	19
age	1.00	older	9
	2.00	younger	10

a. method = Imagery

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Imagery	older	12.3333	3.16228	9
	younger	17.6000	2.59058	10
	Total	15.1053	3.88580	19
Total	older	12.3333	3.16228	9
	younger	17.6000	2.59058	10
	Total	15.1053	3.88580	19

a. method = Imagery

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

Dependent Variable: recall

F	df1	df2	Sig.
.017	1	17	.899

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

a. method = Imagery

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	131.389[b]	1	131.389	15.909	.001	.483	15.909	.964
Intercept	4244.232	1	4244.232	513.903	.000	.968	513.903	1.000
method	.000	0	.	.	.	.000	.000	.
age	131.389	1	131.389	15.909	.001	.483	15.909	.964
method * age	.000	0	.	.	.	.000	.000	.
Error	140.400	17	8.259					
Total	4607.000	19						
Corrected Total	271.789	18						

a. method = Imagery

b. R Squared = .483 (Adjusted R Squared = .453)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

		95% Confidence Interval	
Mean	Std. Error	Lower Bound	Upper Bound
14.967	.660	13.574	16.360

a. method = Imagery

2. method[a]

Dependent Variable: recall

			95% Confidence Interval	
method	Mean	Std. Error	Lower Bound	Upper Bound
Imagery	14.967	.660	13.574	16.360

a. method = Imagery

3. age[a]

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	12.333	.958	10.312	14.354
younger	17.600	.909	15.683	19.517

a. method = Imagery

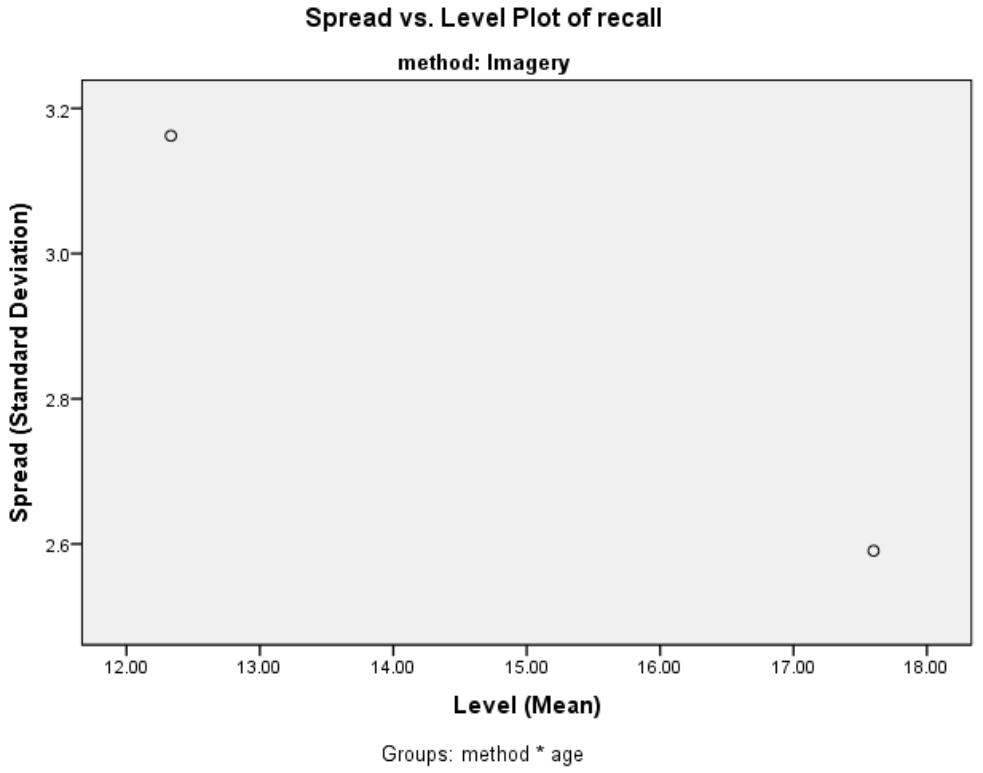
4. method * age[a]

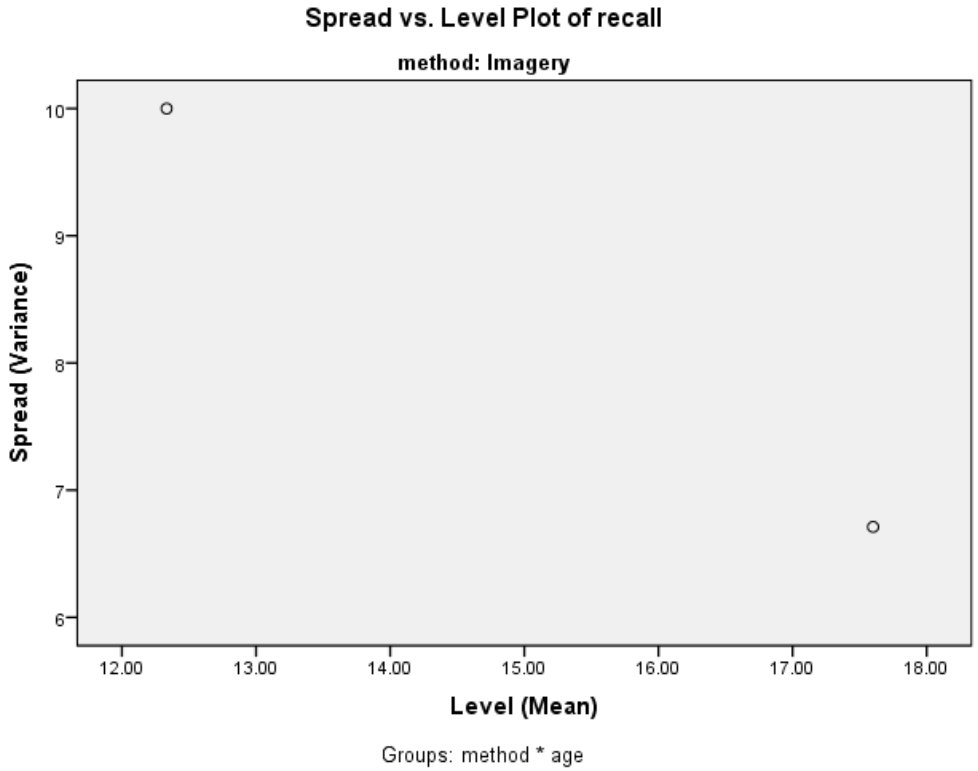
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Imagery	older	12.333	.958	10.312	14.354
	younger	17.600	.909	15.683	19.517

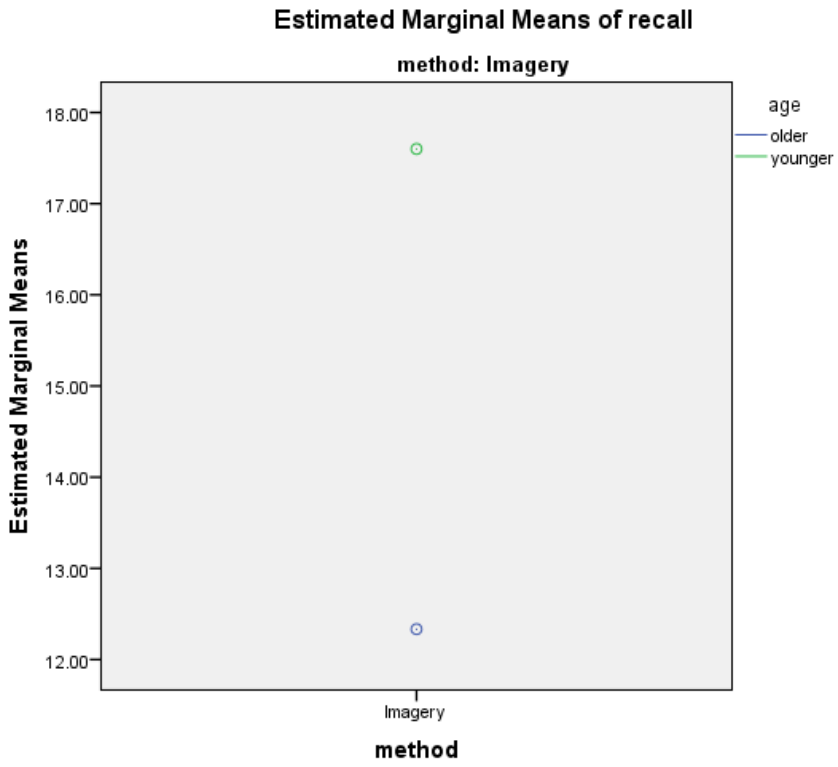
a. method = Imagery

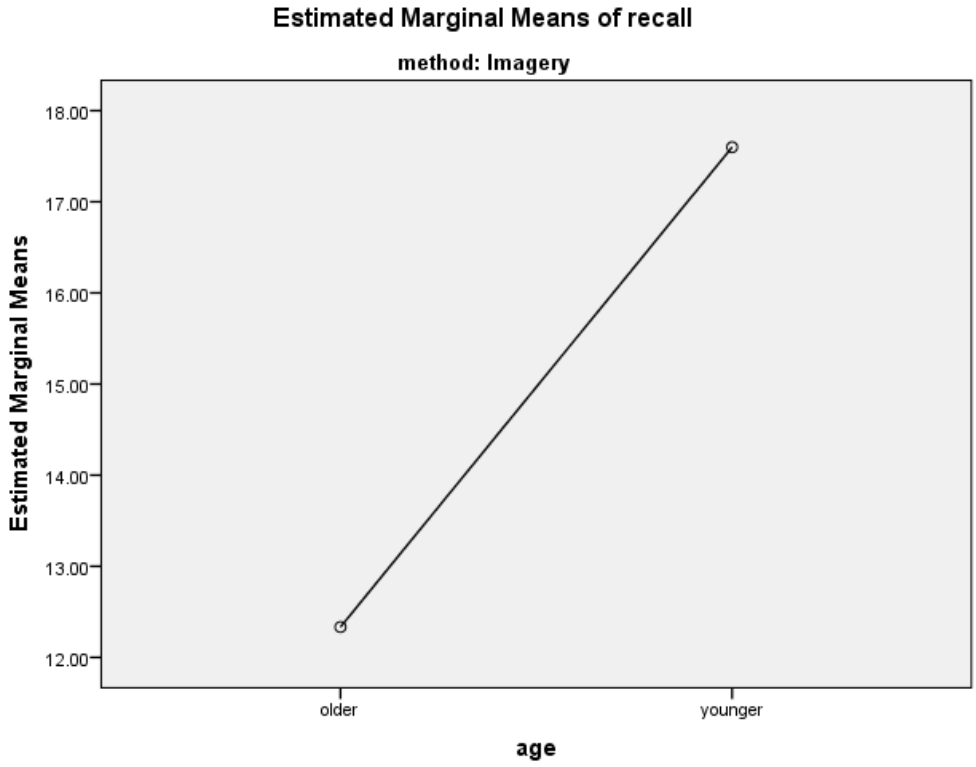
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Imagery
Estimated Marginal Means
18.00
17.00
16.00
15.00
14.00
13.00
12.00
Imagery
method
age
older
younger



method = Control-Intentional

Between-Subjects Factors[a]

		Value Label	N
method	5.00	Control-Intentional	20
age	1.00	older	10
	2.00	younger	10

a. method = Control-Intentional

Descriptive Statistics[a]

Dependent Variable: recall

method	age	Mean	Std. Deviation	N
Control-Intentional	older	12.0000	3.74166	10
	younger	19.3000	2.66875	10
	Total	15.6500	4.90193	20
Total	older	12.0000	3.74166	10
	younger	19.3000	2.66875	10
	Total	15.6500	4.90193	20

a. method = Control-Intentional

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

Dependent Variable: recall

F	df1	df2	Sig.
.383	1	18	.544

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

a. method = Control-Intentional

b. Design: Intercept + method + age + method * age

Tests of Between-Subjects Effects[a]

Dependent Variable: recall

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	266.450[b]	1	266.450	25.229	.000	.584	25.229	.997
Intercept	4898.450	1	4898.450	463.820	.000	.963	463.820	1.000
method	.000	0	.	.	.	.000	.000	.
age	266.450	1	266.450	25.229	.000	.584	25.229	.997
method * age	.000	0	.	.	.	.000	.000	.
Error	190.100	18	10.561					
Total	5355.000	20						

Corrected Total	456.550	19						

a. method = Control-Intentional

b. R Squared = .584 (Adjusted R Squared = .560)

c. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean[a]

Dependent Variable: recall

		95% Confidence Interval	
Mean	Std. Error	Lower Bound	Upper Bound
15.650	.727	14.123	17.177

a. method = Control-Intentional

2. method[a]

Dependent Variable: recall

			95% Confidence Interval	
method	Mean	Std. Error	Lower Bound	Upper Bound
Control-Intentional	15.650	.727	14.123	17.177

a. method = Control-Intentional

3. age[a]

Dependent Variable: recall

			95% Confidence Interval	
age	Mean	Std. Error	Lower Bound	Upper Bound
older	12.000	1.028	9.841	14.159
younger	19.300	1.028	17.141	21.459

a. method = Control-Intentional

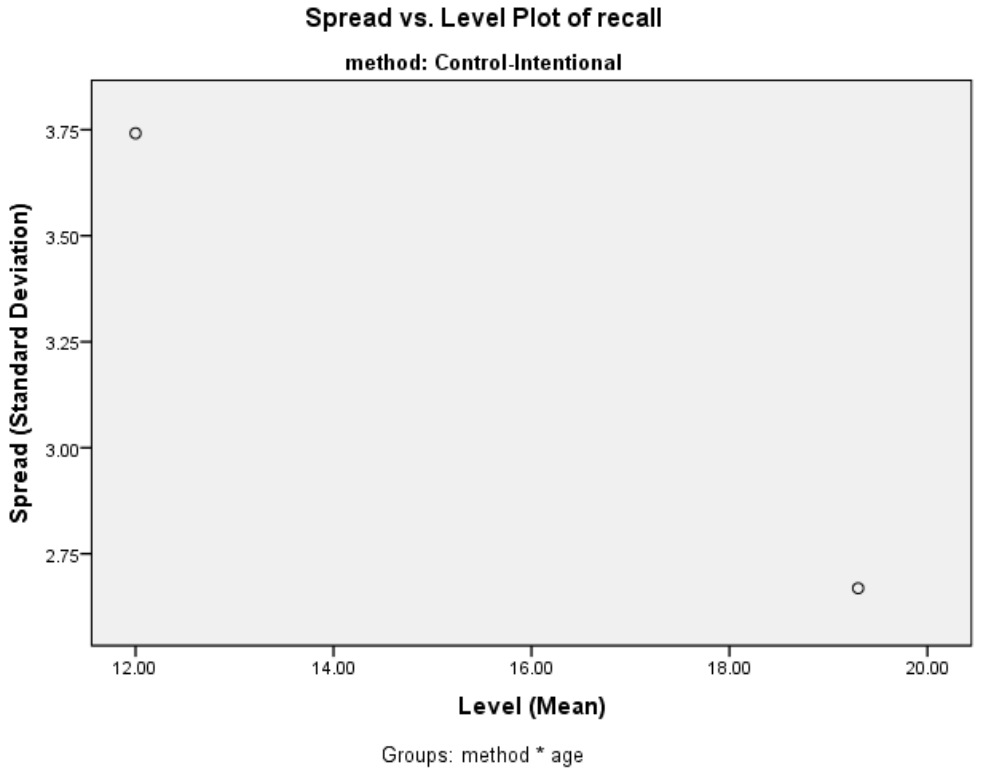
4. method * age[a]

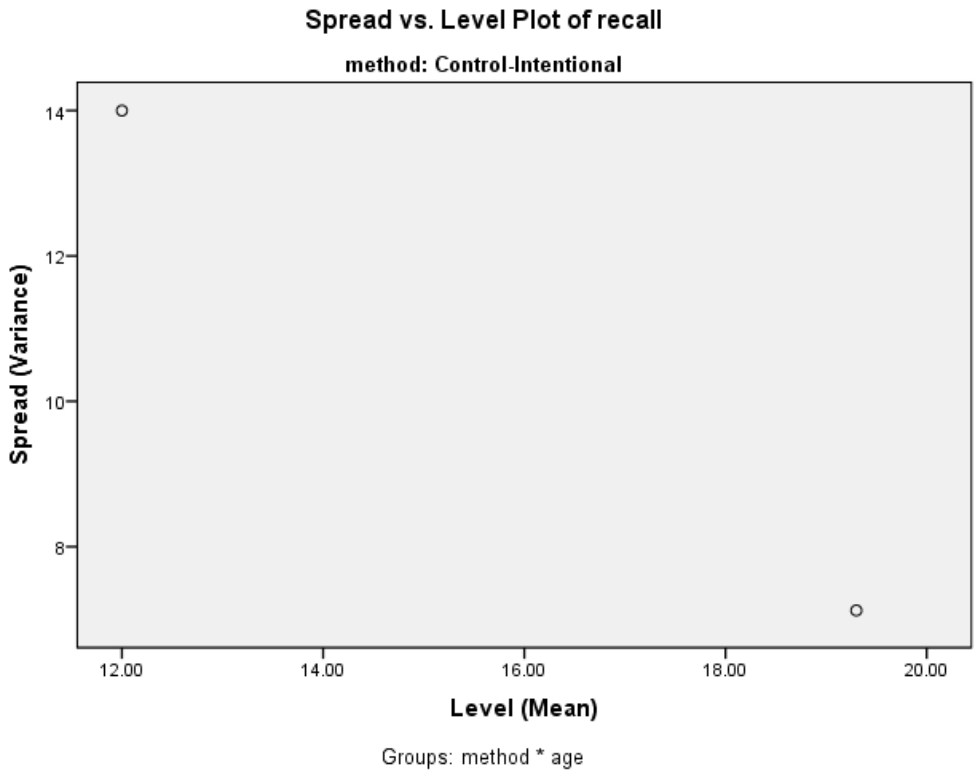
Dependent Variable: recall

method	age	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Control-Intentional	older	12.000	1.028	9.841	14.159
	younger	19.300	1.028	17.141	21.459

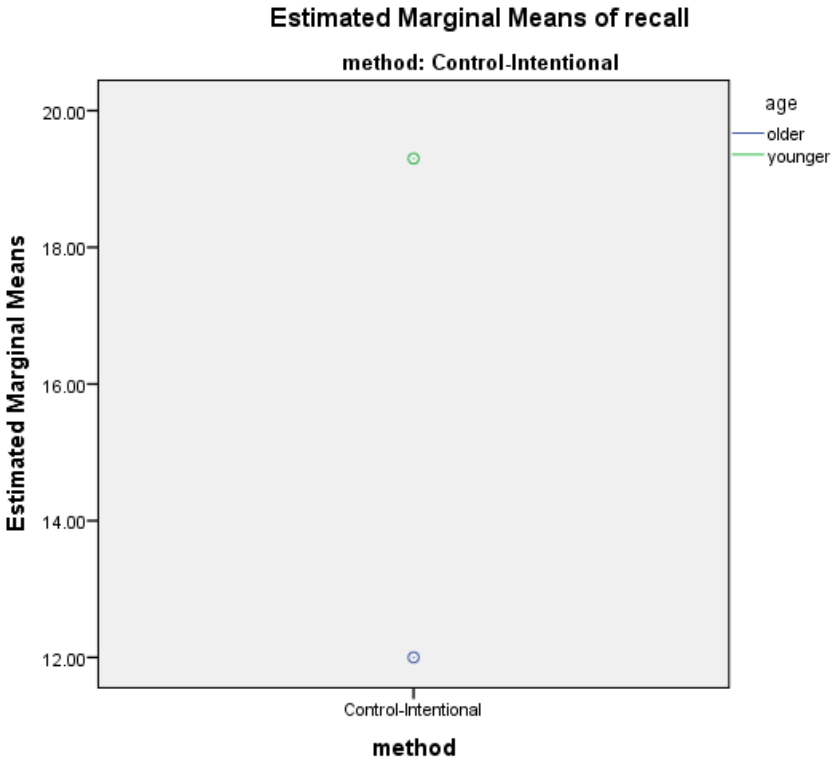
a. method = Control-Intentional

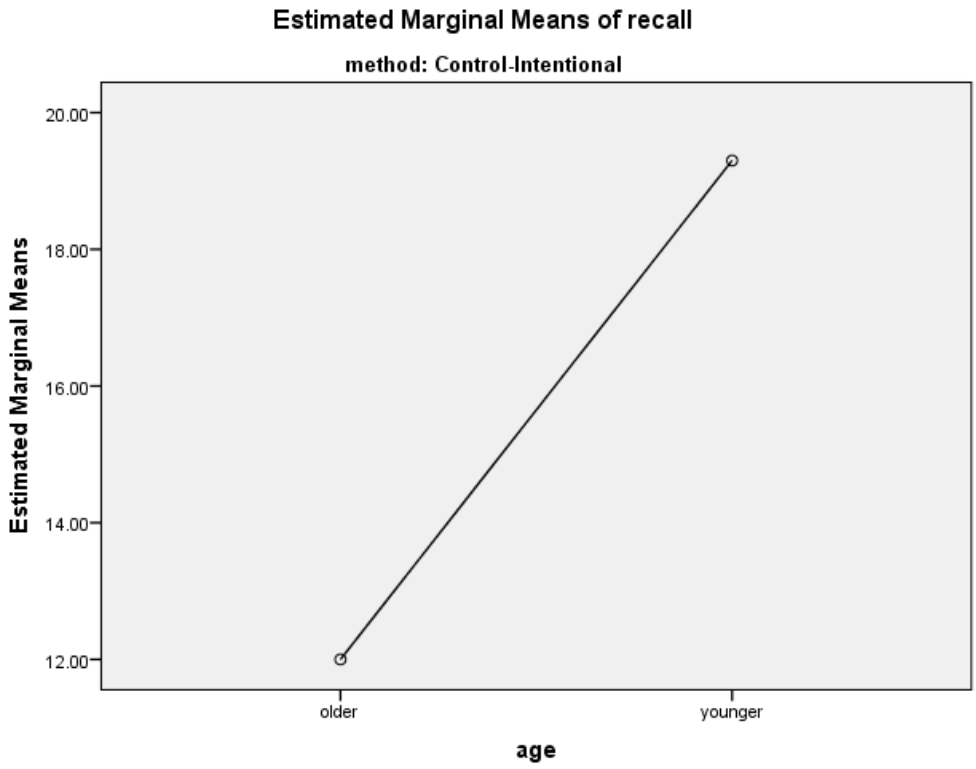
Spread-versus-Level Plots





Profile Plots


Estimated Marginal Means of recall
method: Control-Intentional
Estimated Marginal Means
20.00
18.00
16.00
14.00
12.00
Control-Intentional
method
age
older
younger




```
T-TEST GROUPS=age(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=recall
  /CRITERIA=CI(.95).
```

T-Test

method = Counting

Group Statistics[a]

	age	N	Mean	Std. Deviation	Std. Error Mean
recall	older	10	7.0000	1.82574	.57735
	younger	10	6.5000	1.43372	.45338

a. method = Counting

Independent Samples Test[a]

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
recall	Equal variances assumed	.482	.496	.681	18	.504	.50000	.73409	-1.04227	2.04227
	Equal variances not assumed			.681	17.042	.505	.50000	.73409	-1.04851	2.04851

a. method = Counting

method = Rhyming

Group Statistics[a]

	age	N	Mean	Std. Deviation	Std. Error Mean
recall	older	10	6.9000	2.13177	.67412
	younger	10	7.6000	1.95505	.61824

a. method = Rhyming

Independent Samples Test[a]

	Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
recall	Equal variances assumed	.001	.973	-.765	18	.454	-.70000	.91469	-2.62170	1.22170
	Equal variances not assumed			-.765	17.867	.454	-.70000	.91469	-2.62273	1.22273

a. method = Rhyming

method = Adjective

Group Statistics[a]

	age	N	Mean	Std. Deviation	Std. Error Mean
recall	older	10	11.0000	2.49444	.78881
	younger	10	14.8000	3.48967	1.10353

a. method = Adjective

Independent Samples Test[a]

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
recall	Equal variances assumed	1.455	.243	-2.801	18	.012	-3.80000	1.35647	-6.64983	-.95017
	Equal variances not assumed			-2.801	16.293	.013	-3.80000	1.35647	-6.67138	-.92862

a. method = Adjective

method = Imagery

Group Statistics[a]

	age	N	Mean	Std. Deviation	Std. Error Mean
recall	older	9	12.3333	3.16228	1.05409
	younger	10	17.6000	2.59058	.81921

a. method = Imagery

Independent Samples Test[a]

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
recall	Equal variances assumed	.017	.899	-3.989	17	.001	-5.26667	1.32043	-8.05253	-2.48081
	Equal variances not assumed			-3.945	15.542	.001	-5.26667	1.33500	-8.10352	-2.42981

a. method = Imagery

method = Control-Intentional

Group Statistics[a]

	age	N	Mean	Std. Deviation	Std. Error Mean
recall	older	10	12.0000	3.74166	1.18322
	younger	10	19.3000	2.66875	.84393

a. method = Control-Intentional

Independent Samples Test[a]

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
recall	Equal variances assumed	.383	.544	-5.023	18	.000	-7.30000	1.45335	-10.35337	-4.24663
	Equal variances not assumed			-5.023	16.274	.000	-7.30000	1.45335	-10.37674	-4.22326

a. method = Control-Intentional

ANCOVA Assumptions Normality

```
UNIANOVA FB_min BY trt
  /METHOD=SSTYPE(1)
  /INTERCEPT=INCLUDE
  /SAVE=RESID
  /POSTHOC=trt(BTUKEY)
  /PLOT=PROFILE(trt)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(trt)
  /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=trt.
```

Univariate Analysis of Variance

Notes

Output Created	02-DEC-2015 13:29:19
Comments	

Input	Data	C:\Users\kfair2\AppData\Local\Temp\hw5data_2.sav
	Active Dataset	DataSet1
	Filter	FB_min <= 105 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	44
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		UNIANOVA FB_min BY trt /METHOD=SSTYPE(1) /INTERCEPT=INCLUDE /SAVE=RESID /POSTHOC=trt(BTUKEY) /PLOT=PROFILE(trt) /EMMEANS=TABLES(OVERALL) /EMMEANS=TABLES(trt) /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE /CRITERIA=ALPHA(.05) /DESIGN=trt.
Resources	Processor Time	00:00:00.22
	Elapsed Time	00:00:00.19
Variables Created or Modified	RES_3	Residual for FB_min

Between-Subjects Factors

		N
trt	1.00	10
	2.00	8
	3.00	8
	4.00	8
	5.00	10

Descriptive Statistics

Dependent Variable: FB_min

trt	Mean	Std. Deviation	N
1.00	37.3000	10.82230	10
2.00	42.1625	27.12205	8
3.00	59.5875	18.73983	8
4.00	50.4500	16.87602	8
5.00	39.4300	12.20747	10
Total	45.1114	18.61695	44

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

Dependent Variable: FB_min

F	df1	df2	Sig.
3.665	4	39	.013

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

a. Design: Intercept + trt

Tests of Between-Subjects Effects

Dependent Variable: FB_min

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	2906.996[a]	4	726.749	2.363	.070	.195	9.451	.628
Intercept	89541.546	1	89541.546	291.097	.000	.882	291.097	1.000
trt	2906.996	4	726.749	2.363	.070	.195	9.451	.628
Error	11996.409	39	307.600					
Total	104444.950	44						
Corrected Total	14903.404	43						

a. R Squared = .195 (Adjusted R Squared = .112)

b. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean

Dependent Variable: FB_min

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
45.786	2.660	40.406	51.166

2. trt

Dependent Variable: FB_min

trt	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1.00	37.300	5.546	26.082	48.518
2.00	42.162	6.201	29.620	54.705
3.00	59.588	6.201	47.045	72.130
4.00	50.450	6.201	37.908	62.992
5.00	39.430	5.546	28.212	50.648

Post Hoc Tests

trt

Homogeneous Subsets

FB_min

Tukey B[a,b,c]

trt	N	Subset 1
1.00	10	37.3000
5.00	10	39.4300
2.00	8	42.1625
4.00	8	50.4500
3.00	8	59.5875

Means for groups in homogeneous subsets are displayed.

Based on observed means.

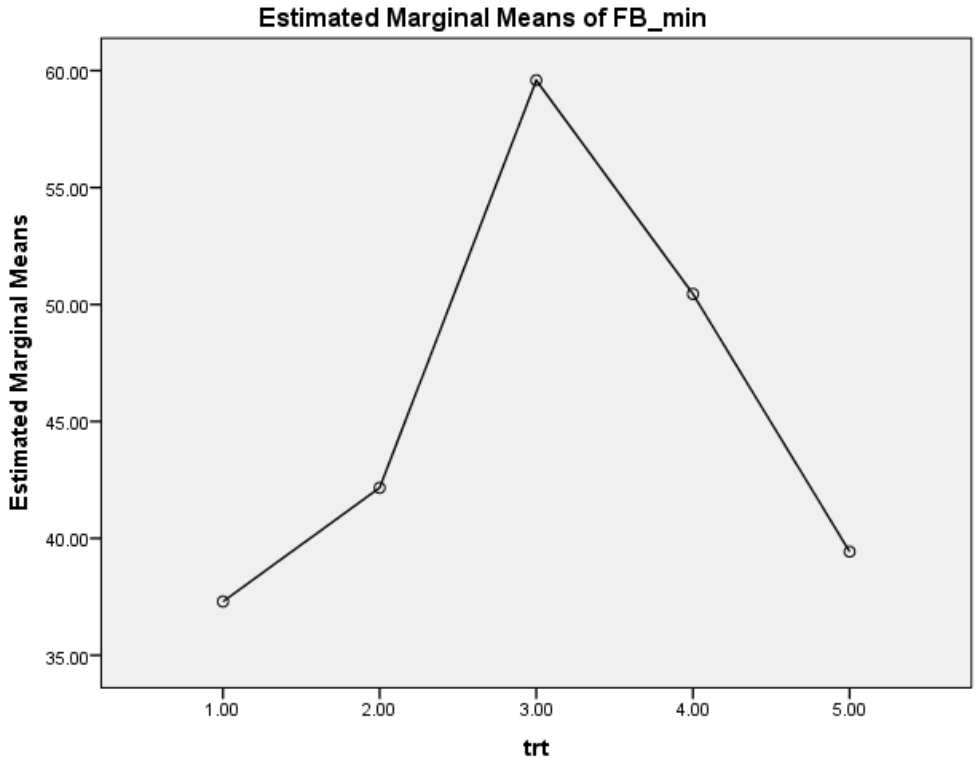
The error term is Mean Square(Error) = 307.600.

a. Uses Harmonic Mean Sample Size = 8.696.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Profile Plots




```
EXAMINE VARIABLES=RES_3
  /PLOT BOXPLOT STEMLEAF NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES EXTREME
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		02-DEC-2015 13:29:40
Comments		
Input	Data	C:\Users\kfair2\AppData\Local\Temp\hw5data_2.sav
	Active Dataset	DataSet1
	Filter	FB_min <= 105 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	44
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.
Syntax		EXAMINE VARIABLES=RES_3 /PLOT BOXPLOT STEMLEAF NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES EXTREME /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.
Resources	Processor Time	00:00:00.64
	Elapsed Time	00:00:00.57

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Residual for FB_min	44	100.0%	0	0.0%	44	100.0%

Descriptives

			Statistic	Std. Error
Residual for FB_min	Mean		.0000	2.51805
	95% Confidence Interval for Mean	Lower Bound	-5.0781	
		Upper Bound	5.0781	
	5% Trimmed Mean		-.4406	
	Median		.1700	
	Variance		278.986	
	Std. Deviation		16.70288	
	Minimum		-30.99	
	Maximum		41.74	
	Range		72.73	
	Interquartile Range		24.66	
	Skewness		.273	.357
	Kurtosis		-.240	.702

Extreme Values

			Case Number	Value
Residual for FB_min	Highest	1	18	41.74
		2	17	34.54
		3	28	23.71
		4	37	23.05
		5	36	18.95
	Lowest	1	21	-30.99
		2	30	-27.25
		3	11	-26.66
		4	12	-23.86
		5	38	-21.23

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual for FB_min	.061	44	.200*	.986	44	.848

*. This is a lower bound of the true significance.

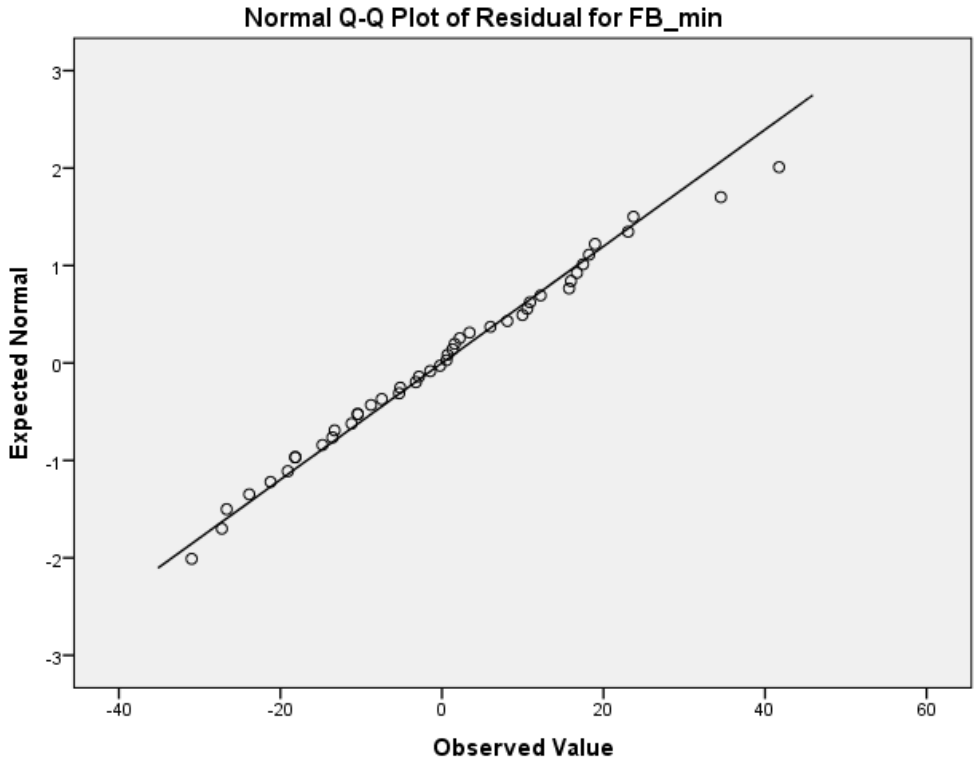
a. Lilliefors Significance Correction

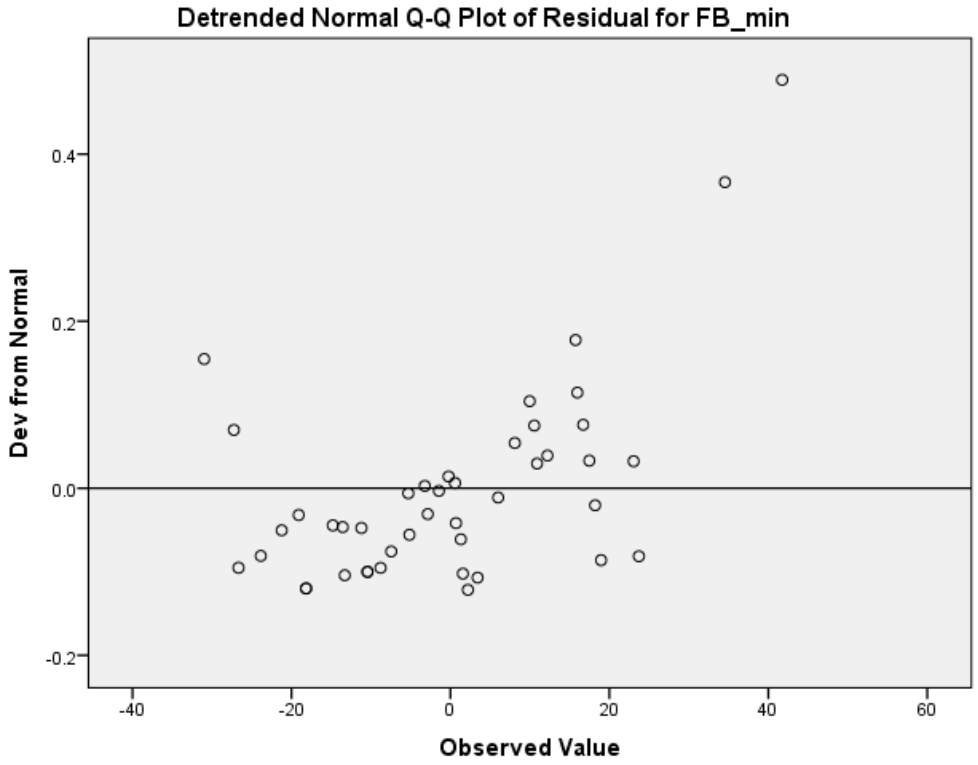
Residual for FB_min

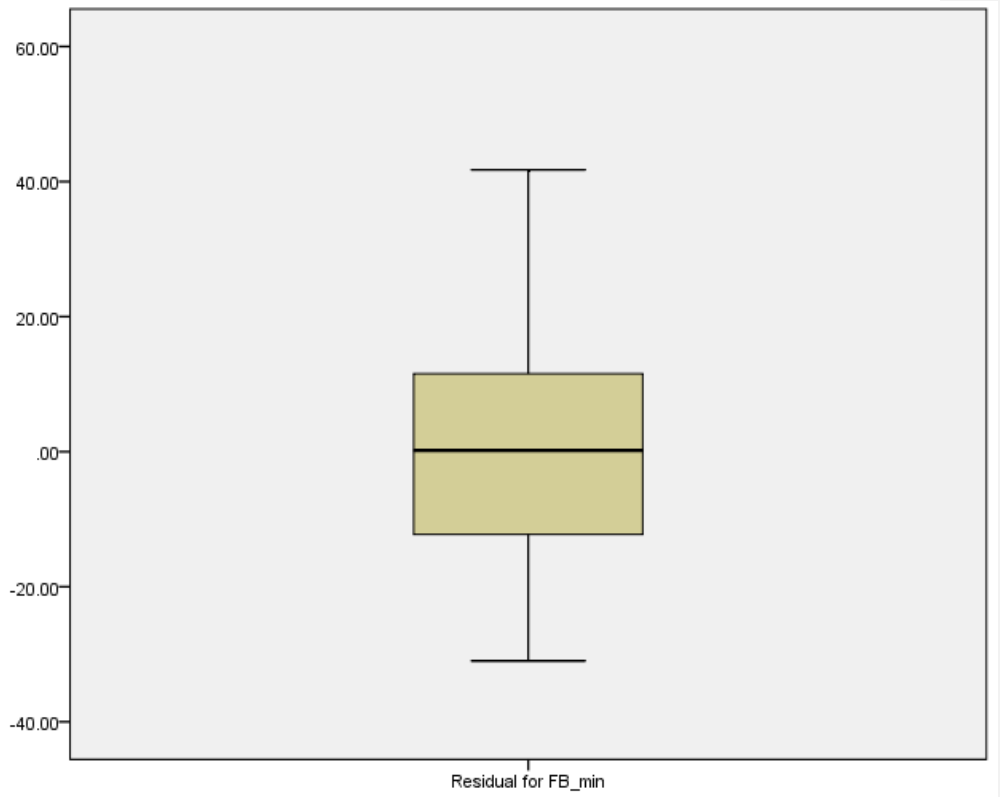
Residual for FB_min Stem-and-Leaf Plot

Frequency	Stem & Leaf
1.00	-3 . 0
4.00	-2 . 1367
9.00	-1 . 001334889
8.00	-0 . 01235578
9.00	0 . 001123689
9.00	1 . 002556788
2.00	2 . 33
1.00	3 . 4
1.00	4 . 1

Stem width: 10.00
Each leaf: 1 case(s)


Normal Q-Q Plot of Residual for FB_min
Expected Normal
Observed Value
3
2
1
0
-1
-2
-3
-40
-20
0
20
40
60


Detrended Normal Q-Q Plot of Residual for FB_min
Dev from Normal
0.4
0.2
0.0
-0.2
-40
-20
0
20
40
60
Observed Value




```
ONEWAY FB_min BY trt
  /STATISTICS DESCRIPTIVES HOMOGENEITY BROWNFORSYTHE WELCH
  /MISSING ANALYSIS.
```

ANCOVA-ANOVA

Oneway

Descriptives

FB_min

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	10	37.3000	10.82230	3.42231	29.5582	45.0418	22.50	54.00
2.00	8	42.1625	27.12205	9.58909	19.4879	64.8371	15.50	83.90
3.00	8	59.5875	18.73983	6.62553	43.9206	75.2544	28.60	83.30
4.00	8	50.4500	16.87602	5.96657	36.3413	64.5587	23.20	73.50
5.00	10	39.4300	12.20747	3.86034	30.6973	48.1627	18.20	56.90
Total	44	45.1114	18.61695	2.80661	39.4513	50.7714	15.50	83.90

Test of Homogeneity of Variances

FB_min

Levene Statistic	df1	df2	Sig.
3.665	4	39	.013

ANOVA

FB_min

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2906.996	4	726.749	2.363	.070
Within Groups	11996.409	39	307.600		
Total	14903.404	43			

Robust Tests of Equality of Means

FB_min

	Statistic[a]	df1	df2	Sig.

Welch	2.557	4	18.048	.074
Brown-Forsythe	2.189	4	23.930	.101

a. Asymptotically F distributed.

ANCOVA Explore

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Residual for FB_min	44	100.0%	0	0.0%	44	100.0%

Descriptives

			Statistic	Std. Error
Residual for FB_min	Mean		.0000	1.63389
	95% Confidence Interval for Mean	Lower Bound	-3.2951	
		Upper Bound	3.2951	
	5% Trimmed Mean		-.0877	
	Median		.0142	
	Variance		117.462	
	Std. Deviation		10.83799	
	Minimum		-24.99	
	Maximum		30.51	
	Range		55.51	
	Interquartile Range		13.76	
	Skewness		.143	.357
	Kurtosis		1.042	.702

Extreme Values

			Case Number	Value
Residual for FB_min	Highest	1	27	30.51
		2	36	21.21
		3	17	18.65
		4	46	13.18
		5	28	11.41
	Lowest	1	30	-24.99
		2	22	-23.19
		3	39	-18.96
		4	11	-15.49
		5	38	-13.36

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual for FB_min	.089	44	.200*	.978	44	.542

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Residual for FB_min

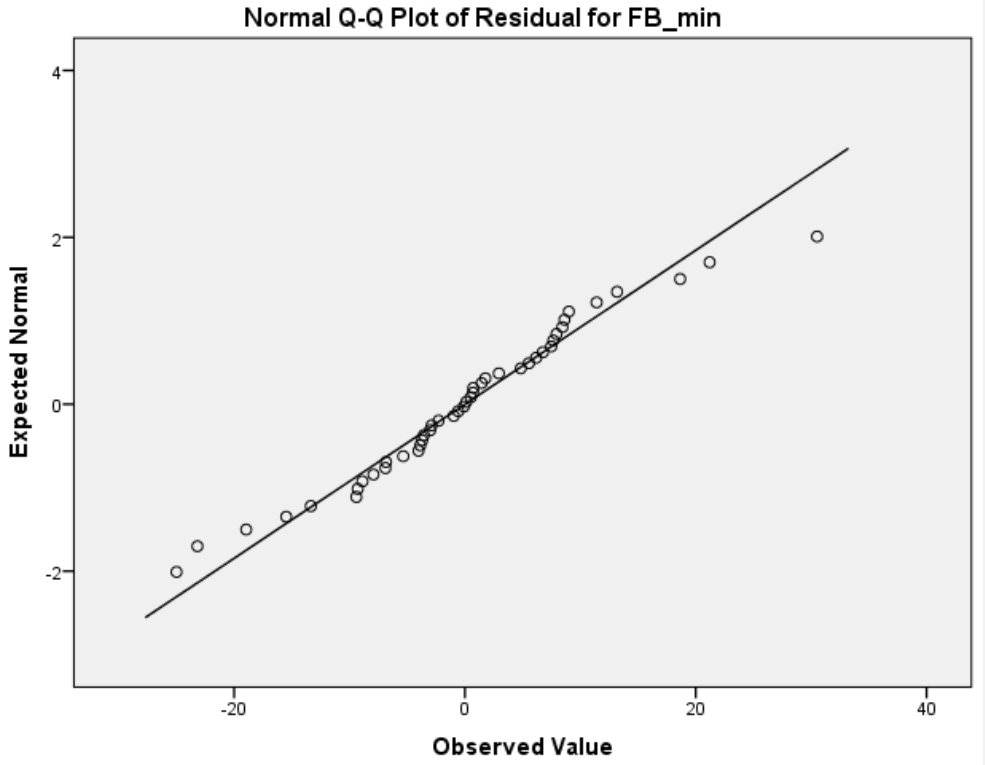
Residual for FB_min Stem-and-Leaf Plot

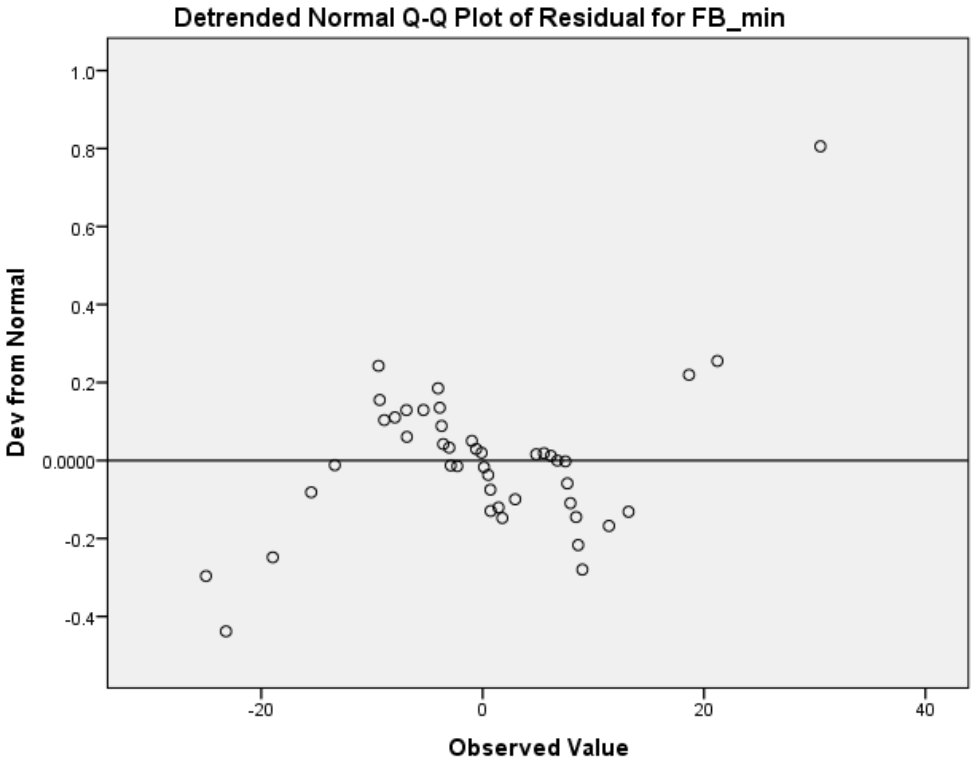
Frequency Stem & Leaf

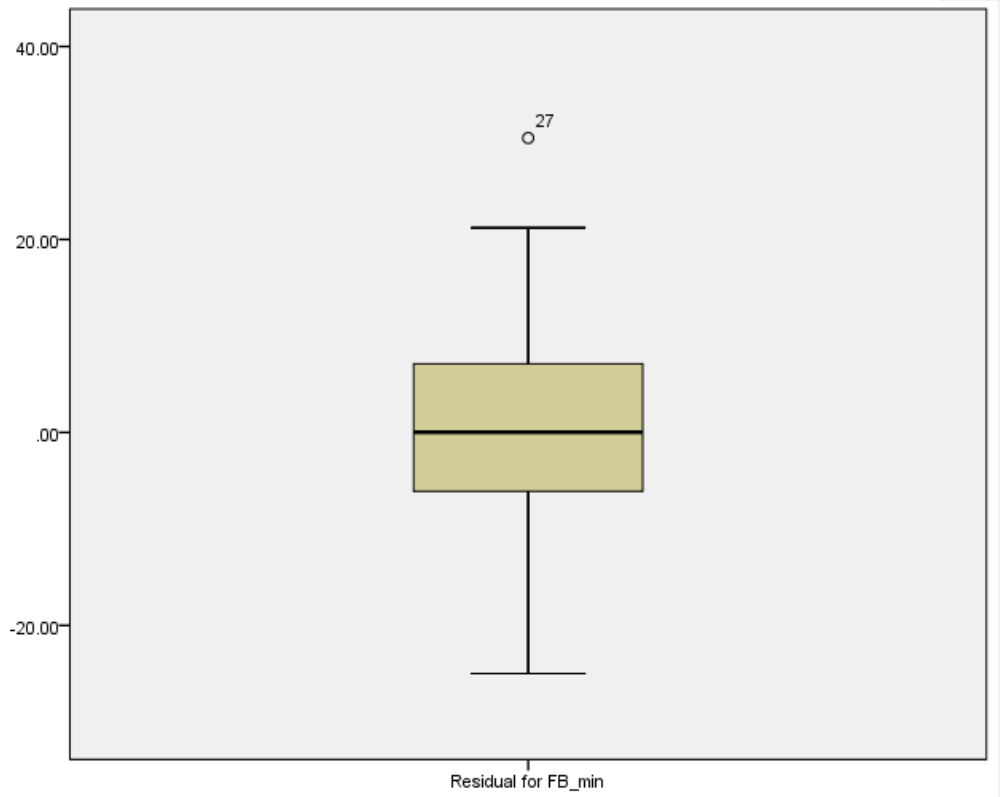
2.00 -2 . 34
2.00 -1 . 58
1.00 -1 . 3
7.00 -0 . 5667899
10.00 -0 . 0002233334
8.00 0 . 00001124
9.00 0 . 566777889
2.00 1 . 13
1.00 1 . 8

1.00 2 . 1
1.00 Extremes (>=31)

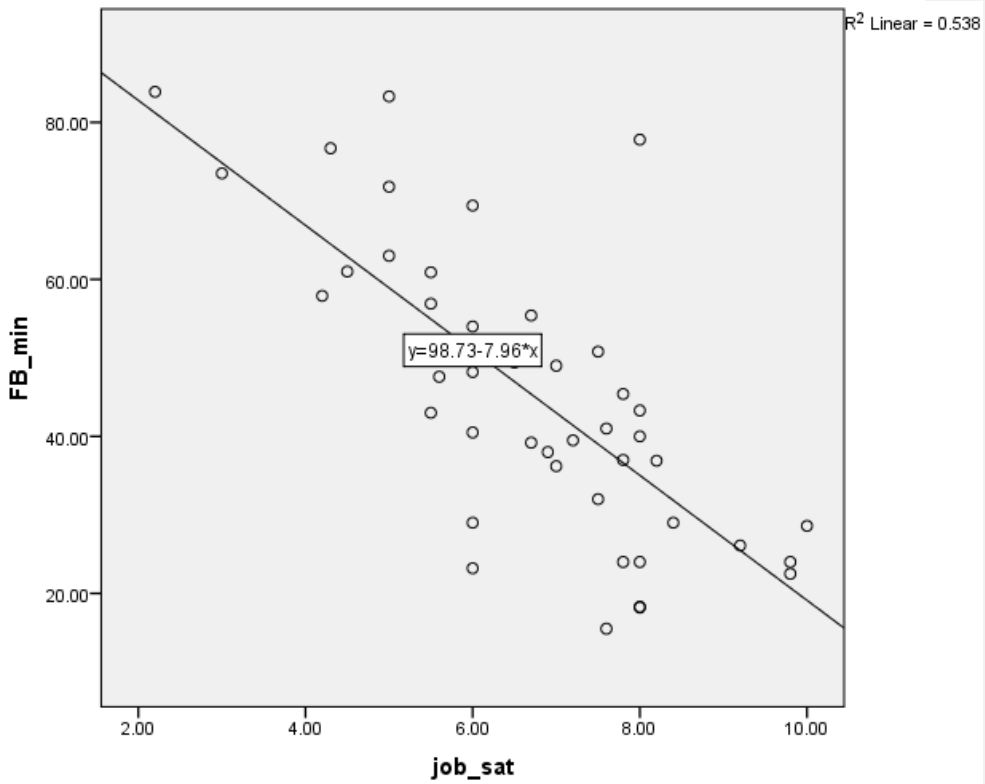
Stem width: 10.00
Each leaf: 1 case(s)



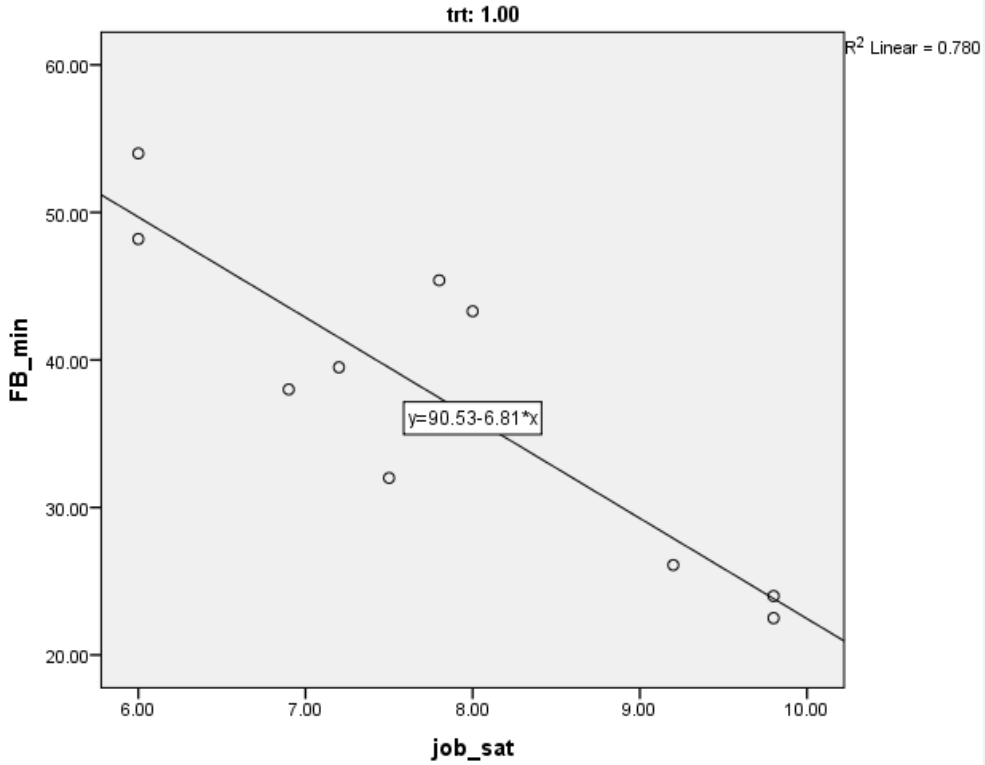

Detrended Normal Q-Q Plot of Residual for FB_min
Dev from Normal
1.0
0.8
0.6
0.4
0.2
0.0000
-0.2
-0.4
-20
0
20
40
Observed Value

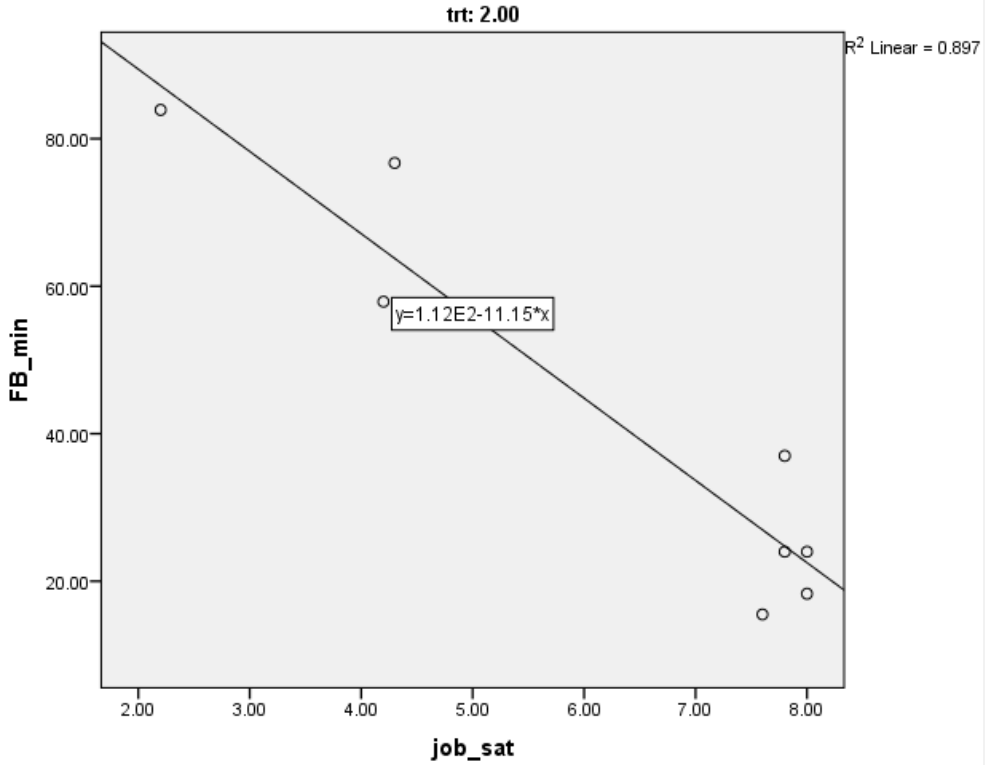


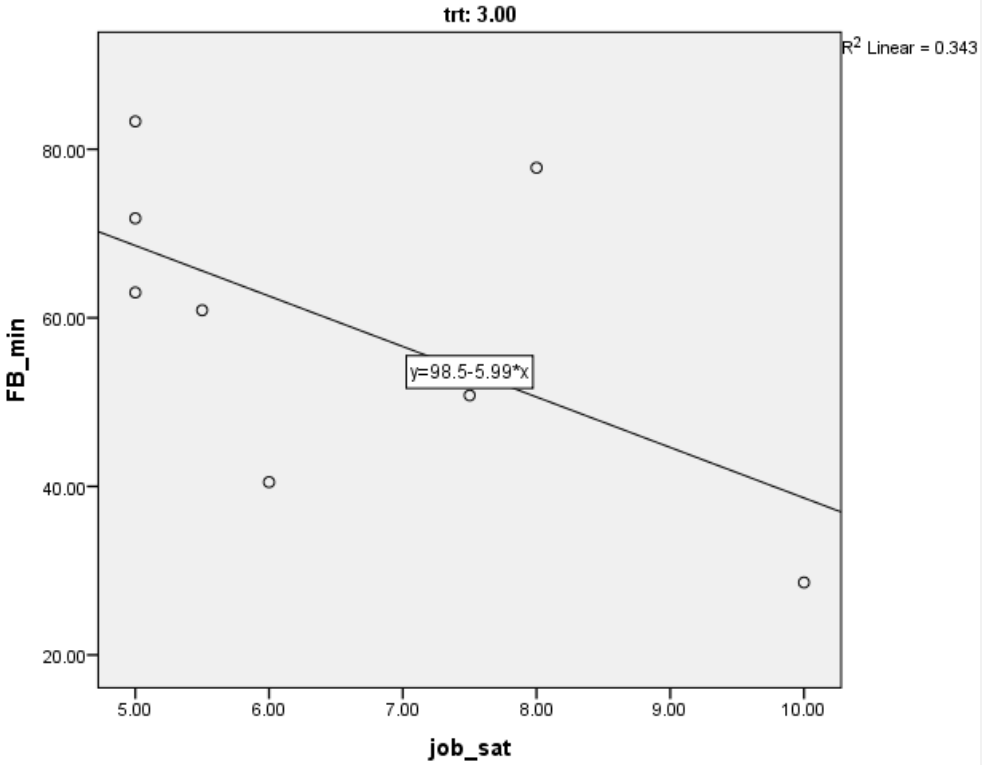
ANCOVA Assumptions Linearity overall
Graph

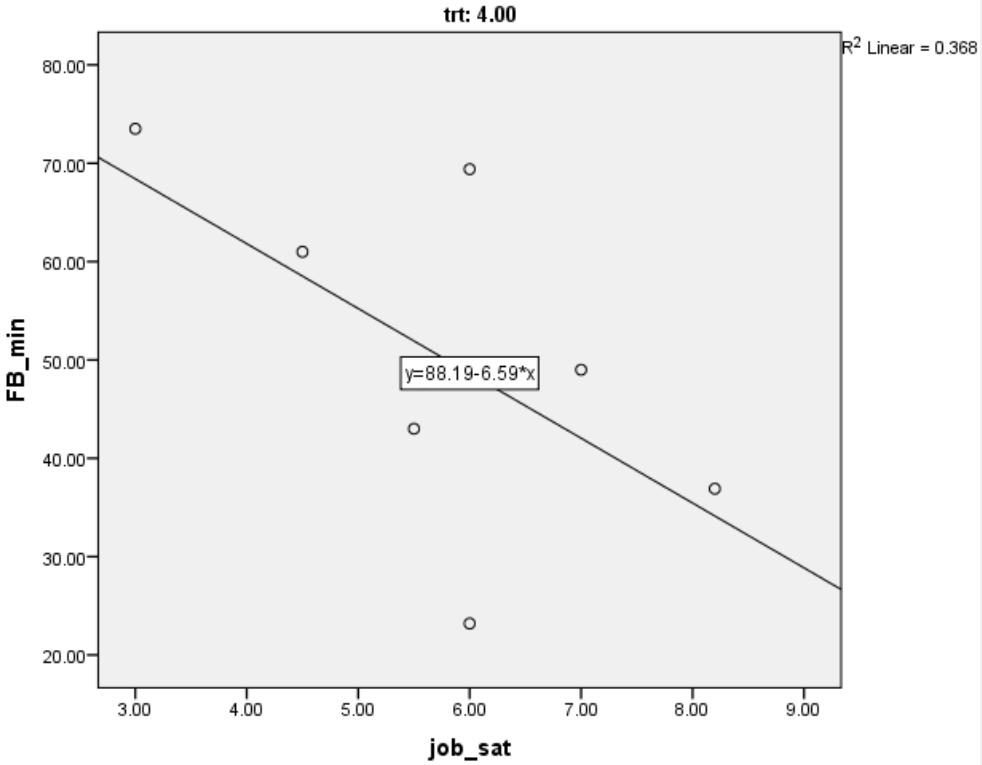

R2 Linear = 0.538
y=98.73-7.96*x
FB_min
80.00
60.00
40.00
20.00
2.00
4.00
6.00
8.00
10.00
job_sat

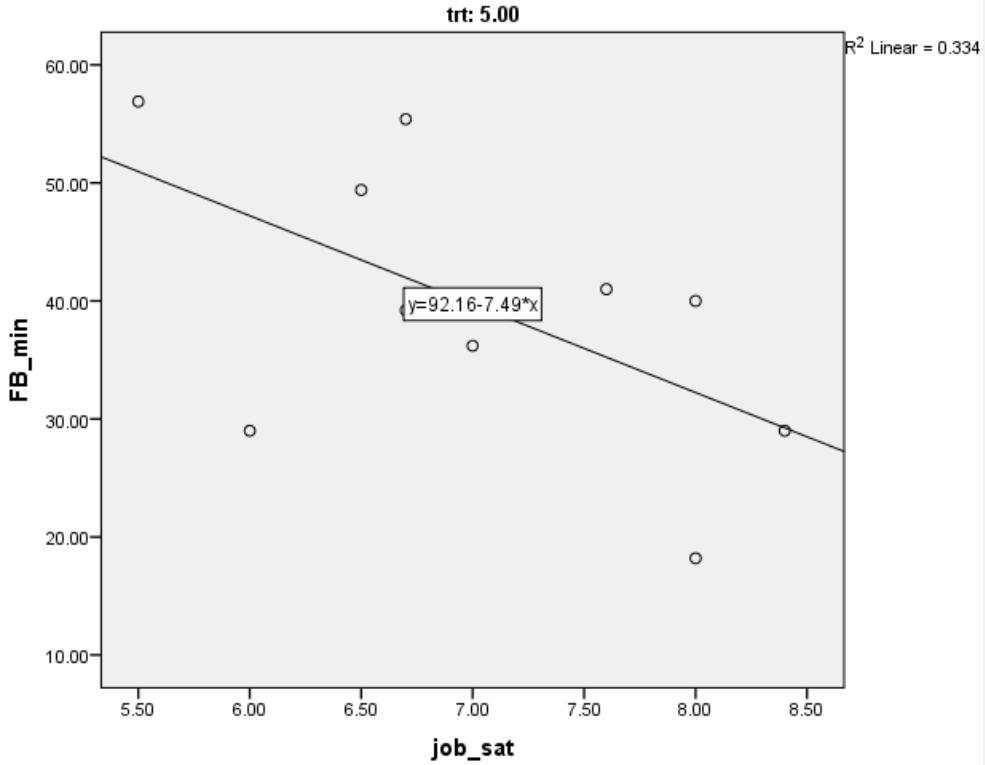
Graph


trt: 1.00
R^2 Linear = 0.780
60.00
50.00
40.00
30.00
20.00
FB_min
y=90.53-6.81*x
6.00
7.00
8.00
9.00
10.00
job_sat


trt: 2.00
R2 Linear = 0.897
y=1.12E2-11.15*x
FB_min
80.00
60.00
40.00
20.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
job_sat


trt: 3.00
R2 Linear = 0.343
y=98.5-5.99*x
FB_min
80.00
60.00
40.00
20.00
5.00
6.00
7.00
8.00
9.00
10.00
job_sat


trt: 4.00
R2 Linear = 0.368
y=88.19-6.59*x
FB_min
job_sat
80.00
70.00
60.00
50.00
40.00
30.00
20.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00



ANCOVA Assumptions Independence of Covar and IV

Oneway

Descriptives

job_sat

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1.00	10	7.8200	1.40380	.44392	6.8158	8.8242	6.00	9.80
2.00	8	6.2375	2.30399	.81459	4.3113	8.1637	2.20	8.00
3.00	8	6.5000	1.83225	.64780	4.9682	8.0318	5.00	10.00
4.00	8	5.7250	1.55357	.54927	4.4262	7.0238	3.00	8.20
5.00	10	7.0400	.94187	.29784	6.3662	7.7138	5.50	8.40
Total	44	6.7341	1.71558	.25863	6.2125	7.2557	2.20	10.00

Test of Homogeneity of Variances

job_sat

Levene Statistic	df1	df2	Sig.
2.949	4	39	.032

ANOVA

job_sat

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23.285	4	5.821	2.198	.087
Within Groups	103.274	39	2.648		
Total	126.559	43			

Robust Tests of Equality of Means

job_sat

	Statistic[a]	df1	df2	Sig.
Welch	2.279	4	17.992	.101
Brown-Forsythe	2.066	4	27.391	.113

a. Asymptotically F distributed.

ANCOVA Assumptions Homo of Regression Slopes

Tests of Between-Subjects Effects

Dependent Variable: FB_min

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	10373.235[a]	9	1152.582	8.650	.000	.696	77.854	1.000
Intercept	89541.546	1	89541.546	672.031	.000	.952	672.031	1.000
trt	2906.996	4	726.749	5.454	.002	.391	21.818	.954
job_sat	6945.537	1	6945.537	52.128	.000	.605	52.128	1.000
trt * job_sat	520.702	4	130.175	.977	.433	.103	3.908	.275
Error	4530.169	34	133.240					
Total	104444.950	44						
Corrected Total	14903.404	43						

a. R Squared = .696 (Adjusted R Squared = .616)

b. Computed using alpha = .05

ANCOVA test

Univariate Analysis of Variance

Between-Subjects Factors

		N
trt	1.00	10
	2.00	8
	3.00	8
	4.00	8
	5.00	10

Descriptive Statistics

Dependent Variable: FB_min

trt	Mean	Std. Deviation	N
1.00	37.3000	10.82230	10
2.00	42.1625	27.12205	8
3.00	59.5875	18.73983	8
4.00	50.4500	16.87602	8
5.00	39.4300	12.20747	10
Total	45.1114	18.61695	44

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

Dependent Variable: FB_min

F	df1	df2	Sig.
.990	4	39	.424

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

a. Design: Intercept + job_sat + trt

Tests of Between-Subjects Effects

Dependent Variable: FB_min

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	9852.533[a]	5	1970.507	14.825	.000	.661	74.125	1.000
Intercept	89541.546	1	89541.546	673.662	.000	.947	673.662	1.000
job_sat	8022.451	1	8022.451	60.357	.000	.614	60.357	1.000
trt	1830.082	4	457.521	3.442	.017	.266	13.769	.808
Error	5050.871	38	132.918					
Total	104444.950	44						
Corrected Total	14903.404	43						

a. R Squared = .661 (Adjusted R Squared = .616)

b. Computed using alpha = .05

Estimated Marginal Means

1. Grand Mean

Dependent Variable: FB_min

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
45.215[a]	1.750	41.672	48.758

a. Covariates appearing in the model are evaluated at the following values: job_sat = 6.7341.

2. trt

Estimates

Dependent Variable: FB_min

trt	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1.00	46.205[a]	3.848	38.415	53.996
2.00	38.090[a]	4.115	29.760	46.420
3.00	57.668[a]	4.085	49.399	65.937
4.00	42.175[a]	4.234	33.604	50.746
5.00	41.939[a]	3.662	34.525	49.353

a. Covariates appearing in the model are evaluated at the following values: job_sat = 6.7341.

Pairwise Comparisons

Dependent Variable: FB_min

(I) trt	(J) trt	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1.00	2.00	8.115	5.756	1.000	-9.039	25.269
	3.00	-11.462	5.670	.503	-28.361	5.436
	4.00	4.031	5.963	1.000	-13.740	21.802

	5.00	4.267	5.231	1.000	-11.324	19.857
2.00	1.00	-8.115	5.756	1.000	-25.269	9.039
	3.00	-19.578*	5.772	.016	-36.781	-2.375
	4.00	-4.085	5.794	1.000	-21.352	13.182
	5.00	-3.849	5.544	1.000	-20.371	12.674
3.00	1.00	11.462	5.670	.503	-5.436	28.361
	2.00	19.578*	5.772	.016	2.375	36.781
	4.00	15.493	5.831	.115	-1.885	32.872
	5.00	15.729	5.503	.069	-.671	32.129
4.00	1.00	-4.031	5.963	1.000	-21.802	13.740
	2.00	4.085	5.794	1.000	-13.182	21.352
	3.00	-15.493	5.831	.115	-32.872	1.885
	5.00	.236	5.669	1.000	-16.658	17.130
5.00	1.00	-4.267	5.231	1.000	-19.857	11.324
	2.00	3.849	5.544	1.000	-12.674	20.371
	3.00	-15.729	5.503	.069	-32.129	.671
	4.00	-.236	5.669	1.000	-17.130	16.658

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Univariate Tests

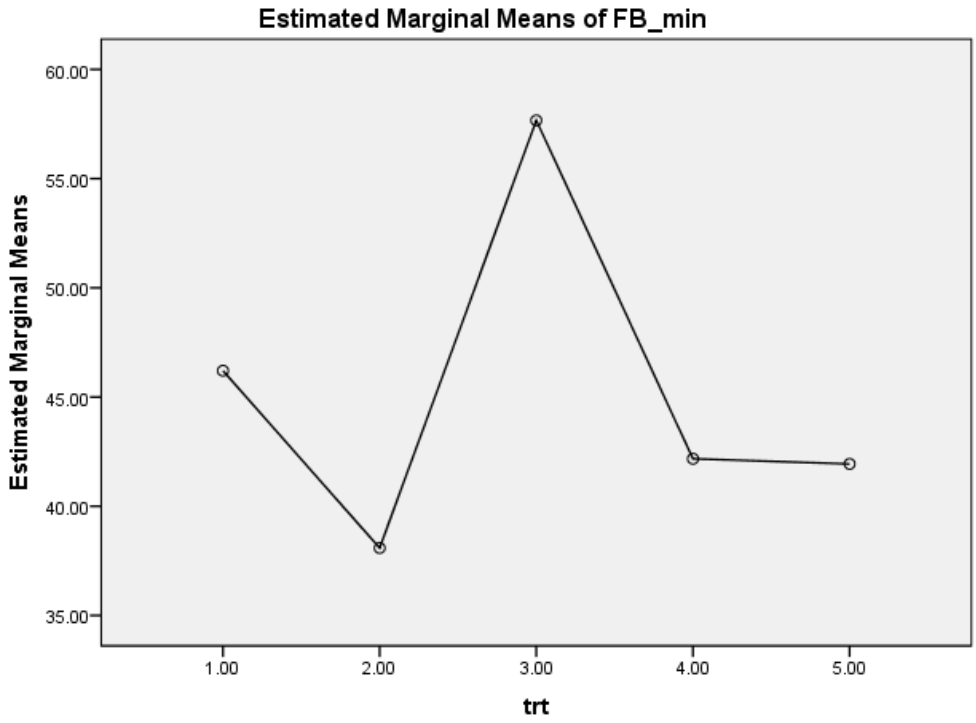
Dependent Variable: FB_min

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Contrast	1830.082	4	457.521	3.442	.017	.266	13.769	.808
Error	5050.871	38	132.918					

The F tests the effect of trt. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

Profile Plots



Covariates appearing in the model are evaluated at the following values: job_sat = 6.7341