# TWO-FACTOR ANOVA

Kim Neuendorf

4/9/18

COM 631/731

## I. MODEL

Using the Humor and Public Opinion Data, a two-factor ANOVA was run, using the full factorial model:

MAIN EFFECT: Political Philosophy (3 groups)	
(Conservative, Middle of Road, Liberal)	Social Currency Humor Appreciation
•	(4-item scale)
MAIN EFFECT: Race (3 groups)	
(White, Black, Other Nonwhite)	
INTERACTION: PolPhil x Race	

## **II. RUNNING SPSS**

SYNTAX TO CREATE 3-GROUP POLITICAL PHILOSOPHY VARIABLE AND 3-GROUP RACE VARIABLE:

RECODE G4 (3=2) (1 thru 2=1) (4 thru 5=3) INTO PolPhil3. COMPUTE RACE3=0. IF (BLACK=1 AND NONWHITE=1)RACE3=2. IF (BLACK=0 AND NONWHITE=0)RACE3=1. IF (BLACK=0 AND NONWHITE=1)RACE3=3.

#### SYNTAX TO CREATE FOUR SENSES OF HUMOR SCALES:

COMPUTE Disparagement=Mean(c7,c21,c30,c46)\*4. VARIABLE LABELS Disparagement 'COMPUTE Disparagement=Mean(c7,c21,c30,c46)\*4'. COMPUTE Dark=Mean(c12,c41,c50,c53)\*4. VARIABLE LABELS Dark 'COMPUTE Dark=Mean(c12,c41,c50,c53)\*4'. COMPUTE Incongruity=Mean(c10,c32,c38,c47)\*4. VARIABLE LABELS Incongruity 'COMPUTE Incongruity=Mean(c10,c32,c38,c47)\*4'. COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4. VARIABLE LABELS SocialCurrency 'COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4'.

### TO RUN ANOVA:

## Analyze $\rightarrow$ General Linear Model $\rightarrow$ Univariate:

ta Humor	HumorSupp041116_1.sav [DataSet1] - IBM SPSS Statistics Data Editor										
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222	Nonv	hite	Numeric	🖶 S <u>i</u> mu	lation						
223	G6		String	Qual	ty Control		•	ur academic major?			
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226	G8		Numeric	0	-		mat is yo	our religious affiliation?			
227	G8B		String	181	0	G8b. (	Other (ple	ease specify)			
228	G9		Numeric	6	0	G9. W	/hat is yo	our annual household income?			
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230	OJIn	iocent3	Numeric	8	2	OJ Inr	ocent 3	groups			
231	Fema	le	Numeric	8	2	Fema	e				

Bring over one dependent variable and two independent variables (placed in the Fixed Factor(s) box as Main Effects). The default for Model is Full Factorial, so nothing needs to be clicked there. (Full Factorial will produce Interaction term(s) along with the Main Effects.)

Click Plots  $\rightarrow$  place one independent variable in the Horizontal Axis box and the other in the Separate Lines box  $\rightarrow$  click Add  $\rightarrow$  click Continue:

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Click Post Hoc  $\rightarrow$  bring over any independent variable(s) with 3 or more categories that you wish to test via post hocs into Post Hoc Tests for  $\rightarrow$  click any tests you wish (e.g., LSD, Bonferroni, Scheffe, Tukey)  $\rightarrow$  click Continue:

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Click Options  $\rightarrow$  bring over all factors and factor interactions into Display Means for  $\rightarrow$  Click Compare main effects  $\rightarrow$  under Display click Descriptive statistics, Estimates of effect size, Observed power, Homogeneity tests, Residual plot  $\rightarrow$  click Continue:

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Click OK on main window to run, or Paste to have the syntax pasted to a syntax file, from which you can then run the procedure.

# **III. SPSS OUTPUT**

```
UNIANOVA SocialCurrency BY RACE3 PolPhil3
/METHOD=SSTYPE(3)
/INTERCEPT=INCLUDE
/POSTHOC=PolPhil3(TUKEY SCHEFFE LSD BONFERRONI)
/PLOT=PROFILE(PolPhil3*RACE3)
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/EMMEANS=TABLES(RACE3*PolPhil3)
/PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE
/PLOT=RESIDUALS
/CRITERIA=ALPHA(.05)
/DESIGN=RACE3 PolPhil3 RACE3*PolPhil3.
```

# Univariate Analysis of Variance

Notes
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Output Created		11-APR-2016 15:20:40
Comments		
Input	Data	C:\Users\1002678\Dropbox\KimTemp\c63116\Pr esentations\HumorSupp041116_1.sav
	Active Dataset	DataSet1
	Filter	<none></none>
	Weight	<none></none>
	Split File	<none></none>
	N of Rows in Working Data File	288
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 SocialCurrency BY RACE3 PolPhil3 /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE
		/POSTHOC=RACE3(TUKEY SCHEFFE LSD
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Resources		00:00:22
	Elapsed Time	00:00:00.22

### **Between-Subjects Factors**

		Value Label	Ν
RACE3	1.00	1=White	144
	2.00	2=Black	40
	3.00	3=Other	20
Political Philosophy-3 groups	1.00	1=Conservative	43
	2.00	2=Middle of the road	62
	3.00	3=Liberal	99

### **Descriptive Statistics**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

RACE3	Political Philosophy-3 groups	Mean	Std. Deviation	Ν
1=White	1=Conservative	28.8788	6.35294	33
	2=Middle of the road	27.5106	6.63938	47
	3=Liberal	29.0729	6.17998	64
	Total	28.5185	6.36702	144
2=Black	1=Conservative	23.1667	3.12517	6
	2=Middle of the road	23.0667	7.85800	10
	3=Liberal	32.2500	7.24869	24
	Total	28.5917	8.19022	40
3=Other	1=Conservative	31.7500	10.90489	4
	2=Middle of the road	25.2000	6.26099	5
	3=Liberal	29.0000	6.92820	11
	Total	28.6000	7.58392	20
Total	1=Conservative	28.3488	6.75025	43

2=Middle of the road	26.6075	6.91149	62
3=Liberal	29.8350	6.60814	99
Total	28.5408	6.84315	204

### Levene's Test of Equality of Error Variances<sup>a</sup>

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

F	df1	df2	Sig.
.873	8	195	.540

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.<sup>a</sup>

a. Design: Intercept + RACE3 + PolPhil3 + RACE3 \* PolPhil3

#### **Tests of Between-Subjects Effects**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	974.234ª	8	121.779	2.783	.006	.102
Intercept	68141.252	1	68141.252	1557.381	.000	.889
RACE3	134.757	2	67.379	1.540	.217	.016
PolPhil3	457.494	2	228.747	5.228	.006	.051
RACE3 * PolPhil3	572.014	4	143.003	3.268	.013	.063
Error	8531.981	195	43.754			
Total	175680.556	204				
Corrected Total	9506.215	203				

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

#### Tests of Between-Subjects Effects

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

Source	Noncent. Parameter	Observed Power <sup>b</sup>
Corrected Model	22.266	.935
Intercept	1557.381	1.000
RACE3	3.080	.325
PolPhil3	10.456	.827
RACE3 * PolPhil3	13.073	.829
Error		
Total		
Corrected Total		

a. R Squared = .102 (Adjusted R Squared = .066)

b. Computed using alpha = .05

## **Estimated Marginal Means**

#### 1. Grand Mean

Dependent Variable: COMPUTE

SocialCurrency=Mean(c64,c65,c66,c67)\*4

		95% Confidence Interval		
Mean	Std. Error	Lower Bound	Upper Bound	
27.766	.704	26.379	29.154	

### 2. RACE3

#### Estimates

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

			95% Confidence Interval		
RACE3	Mean	Std. Error	Lower Bound	Upper Bound	
1=White	28.487	.572	27.360	29.615	
2=Black	26.161	1.224	23.746	28.576	
3=Other	28.650	1.622	25.452	31.848	

#### Pairwise Comparisons

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

		Mean Difference			95% Confidence Interval for Difference <sup>a</sup>	
(I) RACE3	(J) RACE3	(I-J)	Std. Error	Sig.ª	Lower Bound	Upper Bound
1=White	2=Black	2.326	1.351	.087	338	4.991

	3=Other	163	1.719	.925	-3.554	3.228
2=Black	1=White	-2.326	1.351	.087	-4.991	.338
	3=Other	-2.489	2.032	.222	-6.496	1.518
3=Other	1=White	.163	1.719	.925	-3.228	3.554
	2=Black	2.489	2.032	.222	-1.518	6.496

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

#### **Univariate Tests**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	134.757	2	67.379	1.540	.217	.016
Error	8531.981	195	43.754			

#### **Univariate Tests**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	Noncent. Parameter	Observed Power <sup>a</sup>
Contrast	3.080	.325
Error		

The F tests the effect of RACE3. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

## 3. Political Philosophy-3 groups

#### Estimates

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

			95% Confidence Interval		
Political Philosophy-3 groups	Mean	Std. Error	Lower Bound	Upper Bound	
1=Conservative	27.932	1.474	25.025	30.839	
2=Middle of the road	25.259	1.250	22.794	27.724	
3=Liberal	30.108	.849	28.434	31.782	

#### **Pairwise Comparisons**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

(I) Political Philosophy-3 groups	(J) Political Philosophy-3 groups	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
1=Conservative	2=Middle of the road	2.673	1.933	.168
	3=Liberal	-2.176	1.701	.202
2=Middle of the road	1=Conservative	-2.673	1.933	.168
	3=Liberal	-4.849*	1.511	.002
3=Liberal	1=Conservative	2.176	1.701	.202
	2=Middle of the road	4.849 <sup>*</sup>	1.511	.002

#### **Pairwise Comparisons**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	-	95% Confidence Interval for Difference <sup>b</sup>		
(I) Political Philosophy-3 groups	(J) Political Philosophy-3 groups	Lower Bound	Upper Bound	
1=Conservative	2=Middle of the road	-1.139	6.484	
	3=Liberal	-5.531	1.179	
2=Middle of the road	1=Conservative	-6.484	1.139	

	3=Liberal	-7.828	-1.869
3=Liberal	1=Conservative	-1.179	5.531
	2=Middle of the road	1.869	7.828

Based on estimated marginal means

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

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

#### **Univariate Tests**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	457.494	2	228.747	5.228	.006	.051
Error	8531.981	195	43.754			

#### **Univariate Tests**

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	Noncent. Parameter	Observed Power <sup>a</sup>
Contrast	10.456	.827
Error		

The F tests the effect of Political Philosophy-3 groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

### 4. RACE3 \* Political Philosophy-3 groups

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

				95% Confidence Interval		
RACE3	Political Philosophy-3 groups	Mean	Std. Error	Lower Bound	Upper Bound	
1=White	1=Conservative	28.879	1.151	26.608	31.150	
	2=Middle of the road	27.511	.965	25.608	29.414	
	3=Liberal	29.073	.827	27.442	30.704	
2=Black	1=Conservative	23.167	2.700	17.841	28.492	
	2=Middle of the road	23.067	2.092	18.941	27.192	
	3=Liberal	32.250	1.350	29.587	34.913	
3=Other	1=Conservative	31.750	3.307	25.227	38.273	
	2=Middle of the road	25.200	2.958	19.366	31.034	
	3=Liberal	29.000	1.994	25.067	32.933	

### **Post Hoc Tests**

## Political Philosophy-3 groups

#### Multiple Comparisons

Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

	-	-				95% Confidence	
	(I) Political		Mean			Inte	rval
	Philosophy-3	(J) Political Philosophy-	Difference			Lower	Upper
	groups	3 groups	(I-J)	Std. Error	Sig.	Bound	Bound
Tukey	1=Conservative	2=Middle of the road	1.7413	1.31272	.382	-1.3590	4.8416
HSD		3=Liberal	-1.4862	1.20809	.437	-4.3394	1.3670
	2=Middle of the	1=Conservative	-1.7413	1.31272	.382	-4.8416	1.3590
	road	3=Liberal	-3.2275*	1.07129	.008	-5.7576	6974
	3=Liberal	1=Conservative	1.4862	1.20809	.437	-1.3670	4.3394
		2=Middle of the road	3.2275*	1.07129	.008	.6974	5.7576
Scheffe	1=Conservative	2=Middle of the road	1.7413	1.31272	.417	-1.4967	4.9794
		3=Liberal	-1.4862	1.20809	.471	-4.4661	1.4938
	2=Middle of the	1=Conservative	-1.7413	1.31272	.417	-4.9794	1.4967
road		3=Liberal	<b>-</b> 3.2275 <sup>*</sup>	1.07129	.012	-5.8700	5850
	3=Liberal	1=Conservative	1.4862	1.20809	.471	-1.4938	4.4661
		2=Middle of the road	3.2275 <sup>*</sup>	1.07129	.012	.5850	5.8700
LSD	1=Conservative	2=Middle of the road	1.7413	1.31272	.186	8476	4.3303
		3=Liberal	-1.4862	1.20809	.220	-3.8688	.8964
	2=Middle of the	1=Conservative	-1.7413	1.31272	.186	-4.3303	.8476
	road	3=Liberal	-3.2275*	1.07129	.003	-5.3403	-1.1147
	3=Liberal	1=Conservative	1.4862	1.20809	.220	8964	3.8688
		2=Middle of the road	3.2275*	1.07129	.003	1.1147	5.3403
Bonferro	1=Conservative	2=Middle of the road	1.7413	1.31272	.559	-1.4287	4.9113
ni		3=Liberal	-1.4862	1.20809	.660	-4.4035	1.4311
	2=Middle of the	1=Conservative	-1.7413	1.31272	.559	-4.9113	1.4287
	road	3=Liberal	-3.2275 <sup>*</sup>	1.07129	.009	-5.8145	6405
	3=Liberal	1=Conservative	1.4862	1.20809	.660	-1.4311	4.4035
		2=Middle of the road	3.2275*	1.07129	.009	.6405	5.8145

٦

Based on observed means.

The error term is Mean Square(Error) = 43.754.

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

#### **Multiple Comparisons**

### **Homogeneous Subsets**

			Subset		
	Political Philosophy-3 groups	N	1	2	
Tukey HSD <sup>a,b,c</sup>	2=Middle of the road	62	26.6075		
	1=Conservative	43	28.3488	28.3488	
	3=Liberal	99		29.8350	
	Sig.		.318	.433	
Scheffe <sup>a,b,c</sup>	2=Middle of the road	62	26.6075		
	1=Conservative	43	28.3488	28.3488	
	3=Liberal	99		29.8350	
	Sig.		.352	.467	

#### COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

Means for groups in homogeneous subsets are displayed.

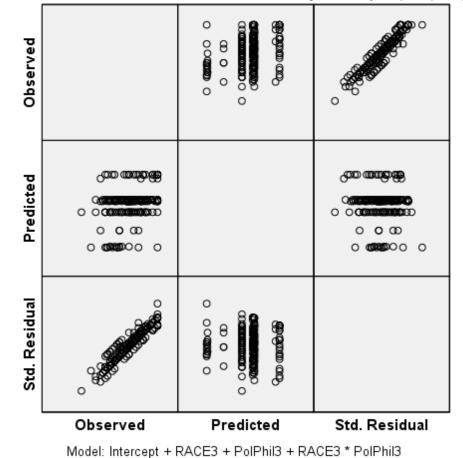
Based on observed means.

The error term is Mean Square(Error) = 43.754.

a. Uses Harmonic Mean Sample Size = 60.623.

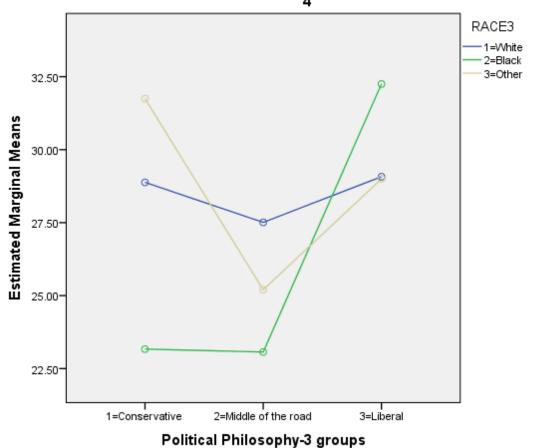
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.



Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4

### **Profile Plots**



Estimated Marginal Means of COMPUTE SocialCurrency=Mean(c64,c65,c66,c67) \*4

# **IV. TABLING RESULTS**

Table 1.

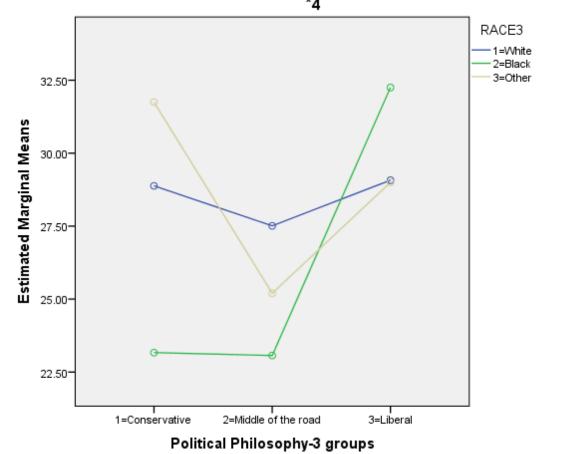
Two-Factor ANOVA Predicting Social Currency Humor Appreciation from Race and Political Philosophy

тттозорну									
				Sum of		Mean			Partial
	Mean	sd	n	Squares	df	Square	F	Sig.	eta <sup>2</sup>
Race				134.76	2	67.38	1.54	.22	.02
White	28.52	6.37	144						
Black	28.59	8.19	40						
Other Nonwhite	28.60	7.58	20						
Political Philosophy				457.49	2	228.75	5.23	.006	.05
Conservative	28.35	6.75	43						
Middle of the road	26.61	6.91	62						
Liberal	29.84	6.61	99						
Race X Political									
Philosophy									
Interaction				572.01	4	143.00	3.27	.01	.06
White/Conservative	28.88	6.35	33						
White/MOTR	27.51	6.64	47						
White/Liberal	29.07	6.18	64						
Black/Conservative	23.17	3.13	6						
Black/MOTR	23.07	7.86	10						
Black/Liberal	32.25	7.25	24						
Other/Conservative	31.75	10.90	4						
Other/MOTR	25.20	6.26	5						
Other/Liberal	29.00	6.93	11						
Error				8531.98	195	43.75			
Corrected Total				9506.22	203				
			-		1 6 6		6.04		

NOTE: The grand mean for this analysis was 28.54, with a *sd* of 6.84 and an *n* of 204.

Figure 1.

Significant Interaction of Race and Political Philosophy in the Prediction of Social Currency Humor Appreciation.



Estimated Marginal Means of COMPUTE SocialCurrency=Mean(c64,c65,c66,c67) \*4

# V. RESULTS WRITEUP

The results of a two-factor ANOVA predicting appreciation of social currency humor from race and political philosophy are shown in Table 1. The main effect of race is non-significant (p = .22), while the main effect for political philosophy is significant ( $F_{(2,195)} = 5.23$ , p = .006), with a partial eta<sup>2</sup> of .05. Liberals were found to have the highest appreciation of social currency humor (mean = 29.84), followed by conservatives (mean = 28.35) and then those with a middle of the road political philosophy (mean = 26.61).

The interaction between race and political philosophy was also found to be significant in the prediction of appreciation of social currency humor ( $F_{(4,195)} = 3.27$ , p = .01). Figure 1 shows the nature of this significant interaction. Among conservatives, there are clear differences in social currency humor appreciation among the races, with Black respondents the lowest and Other Nonwhite respondents the highest. Among those with a middle of the road political philosophy, the differences are smaller, White respondents are the highest group, and all races have a relatively low appreciation of social currency humor, with small or negligible differences among the races.