

# TWO-FACTOR ANOVA

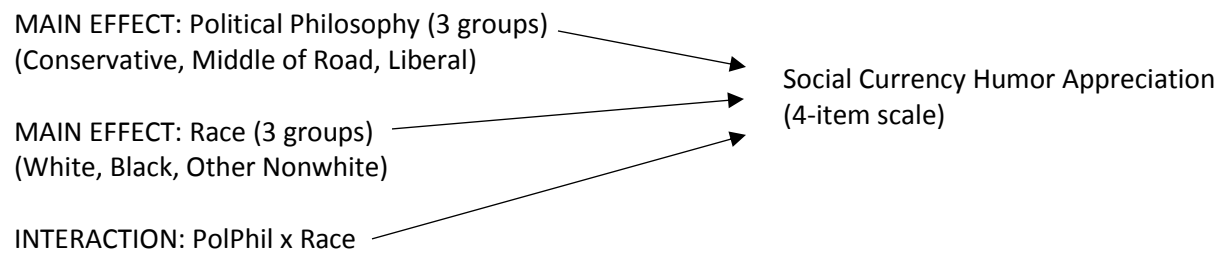
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4/11/19

COM 631

## I. MODEL

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



## 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 → General Linear Model → Univariate:

The screenshot shows the IBM SPSS Statistics Data Editor interface. The 'Analyze' menu is open, and the path 'General Linear Model' > 'Univariate...' is selected. The data editor displays a list of variables with their names and types.

	Name	Type
208	F49	Numeric
209	F50	Numeric
210	F51	Numeric
211	F52	Numeric
212	F53	Numeric
213	F54	Numeric
214	F55	Numeric
215	F56	Numeric
216	G1	Numeric
217	G2	Numeric
218	G3	Numeric
219	G4	Numeric
220	G5	String
221	Black	Numeric
222	Nonwhite	Numeric
223	G6	String
224	G7	Numeric
225	G7B	String
226	G8	Numeric
227	G8B	String
228	G9	Numeric
229	OJInnocent	Numeric
230	OJInnocent3	Numeric
231	Female	Numeric

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 → place one independent variable in the Horizontal Axis box and the other in the Separate Lines box → click Add → click Continue:

The screenshot shows the SPSS Univariate dialog box and its Profile Plots sub-dialog box. The Univariate dialog box is open, showing the following settings:

- Dependent Variable:** COMPUTE SocialCurrency=Mean(c64,c65,c...
- Fixed Factor(s):** RACE3, Political Philosophy-3 groups [PolPhil3]
- Random Factor(s):** (empty)
- Covariate(s):** (empty)
- WLS Weight:** (empty)

The Univariate: Profile Plots dialog box is also open, showing the following settings:

- Factors:** RACE3, PolPhil3
- Horizontal Axis:** PolPhil3
- Separate Lines:** RACE3
- Separate Plots:** (empty)
- Plots:** PolPhil3\*RACE3

The background shows a list of variables in the SPSS data editor, including 'ID', 'A1' through 'A15', and various computed variables like 'Iosophy-3 groups', 'Disparagement=Mean(c7,c21,c30,c46)\*4', 'Dark=Mean(c12,c41,c50,c53)\*4', and 'Incongruity=Mean(c10,c32,c38,c47)\*4'.

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

The screenshot shows the SPSS Univariate: Post Hoc Multiple Comparisons for Observed Means dialog box. The 'Factor(s)' list contains 'RACE3' and 'Political Philosophy-3 groups [PolPhil3]'. The 'Post Hoc Tests for:' list contains 'PolPhil3'. Under the 'Equal Variances Assumed' section, the following tests are checked: LSD, Bonferroni, and Scheffe. Under the 'Equal Variances Not Assumed' section, Tukey is checked. The 'Continue' button is highlighted.

Label	Values	Missing	Columns	Align	Measure	Role
ossible humor mechanism is that which relies on fam...	None	None	255	Left	Nominal	Input
ink of any type of humor that is not included in the f...	None	None	255	Left	Nominal	Input
te a recent instance when you laughed or found som...	None	None	255	Left	Nominal	Input
qual opportunity for all)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
ony (at peace with myself)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
er (control ov						
ratification of						
edom of act						
Life (emphas						
elonging (feel						
r (stability of						
y Life (stimula						
n Life (a purp						
s (courtesy, g						
aterial posse						
Security (prot						
ect (belief in						
tion of Favors						
(uniqueness,						
t Peace (free						
or Tradition (p						
ve (deep emc						
pline (self-res						
nt (from worldly concerns)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
curity (safety for loved ones)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
cognition (respect, approval by others)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
Nature (fitting into nature)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
ife (filled with challenge, novelty, and change)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
a mature understanding of life)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
(the right to lead or command)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
dship (close, supportive friends)	{-1, -1-Oppo...	None	6	Right	Nominal	Input
f Reality (beauty of nature and the art)	{-1, -1-Oppo...	None	6	Right	Nominal	Input

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

The screenshot shows the SPSS Univariate: Options dialog box. The 'Estimated Marginal Means' section is configured as follows:

- Factor(s) and Factor Interactions:** OVERALL, RACE3, PolPhil3, RACE3\*PolPhil3
- Display Means for:** (OVERALL), RACE3, PolPhil3, RACE3\*PolPhil3
- Compare main effects
- Confidence interval adjustment:** LSD(none)

The 'Display' section has the following options checked:

- Descriptive statistics
- Estimates of effect size
- Observed power
- Homogeneity tests
- Residual plot
- General estimable function

Other settings include: Significance level: .05, Confidence intervals are 95.0 %.

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)
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(RACE3) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(PolPhil3) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(RACE3*PolPhil3)
  /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE
  /PLOT=RESIDUALS
  /CRITERIA=ALPHA(.05)
  /DESIGN=RACE3 PolPhil3 RACE3*PolPhil3.
```

## Univariate Analysis of Variance

### Notes

Output Created		11-APR-2016 15:20:40
Comments		
Input	Data	C:\Users\1002678\Dropbox\KimTemp\c631116\Presentations\HumorSupp041116_1.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<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		<pre> UNIANOVA SocialCurrency BY RACE3 PolPhil3 /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /POSTHOC=RACE3(TUKEY SCHEFFE LSD BONFERRONI) /PLOT=PROFILE(PolPhil3*RACE3) /EMMEANS=TABLES(OVERALL) /EMMEANS=TABLES(RACE3) COMPARE ADJ(LSD) /EMMEANS=TABLES(PolPhil3) COMPARE ADJ(LSD) /EMMEANS=TABLES(RACE3*PolPhil3) /PRINT=OPOWER ETASQ HOMOGENEITY DESCRIPTIVE /PLOT=RESIDUALS /CRITERIA=ALPHA(.05) /DESIGN=RACE3 PolPhil3 RACE3*PolPhil3. </pre>
Resources	Processor Time	00:00:00.22
	Elapsed Time	00:00:00.22



**Between-Subjects Factors**

		Value Label	N
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	N
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

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

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	974.234 <sup>a</sup>	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				

### 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

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

### 2. RACE3

#### Estimates

Dependent Variable: COMPUTE

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

RACE3	Mean	Std. Error	95% Confidence Interval	
			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

(I) RACE3	(J) RACE3	Mean Difference (I-J)	Std. Error	Sig. <sup>a</sup>	95% Confidence Interval for Difference <sup>a</sup>	
					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

Political Philosophy-3 groups	Mean	Std. Error	95% Confidence Interval	
			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 <sup>*</sup>	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

(I) Political Philosophy-3 groups	(J) Political Philosophy-3 groups	95% Confidence Interval for Difference <sup>b</sup>	
		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

RACE3	Political Philosophy-3 groups	Mean	Std. Error	95% Confidence Interval	
				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

	(I) Political Philosophy-3 groups	(J) Political Philosophy- 3 groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	1=Conservative	2=Middle of the road	1.7413	1.31272	.382	-1.3590	4.8416
		3=Liberal	-1.4862	1.20809	.437	-4.3394	1.3670
	2=Middle of the road	1=Conservative	-1.7413	1.31272	.382	-4.8416	1.3590
		3=Liberal	-3.2275*	1.07129	.008	-5.7576	-.6974
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 road	1=Conservative	-1.7413	1.31272	.417	-4.9794	1.4967
		3=Liberal	-3.2275*	1.07129	.012	-5.8700	-.5850
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 road	1=Conservative	-1.7413	1.31272	.186	-4.3303	.8476
		3=Liberal	-3.2275*	1.07129	.003	-5.3403	-1.1147
Bonferro ni	1=Conservative	2=Middle of the road	1.7413	1.31272	.559	-1.4287	4.9113
		3=Liberal	-1.4862	1.20809	.660	-4.4035	1.4311
	2=Middle of the road	1=Conservative	-1.7413	1.31272	.559	-4.9113	1.4287
		3=Liberal	-3.2275*	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

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

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

		N	Subset	
			1	2
Political Philosophy-3 groups				
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

Means for groups in homogeneous subsets are displayed.

Based on observed means.

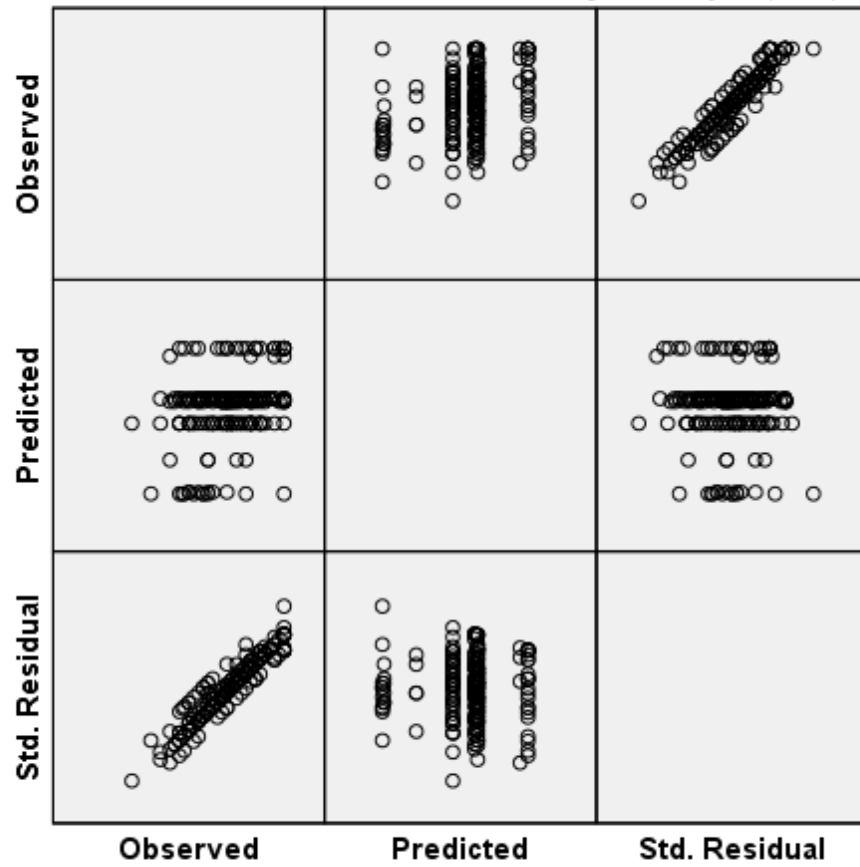
The error term is Mean Square(Error) = 43.754.

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.

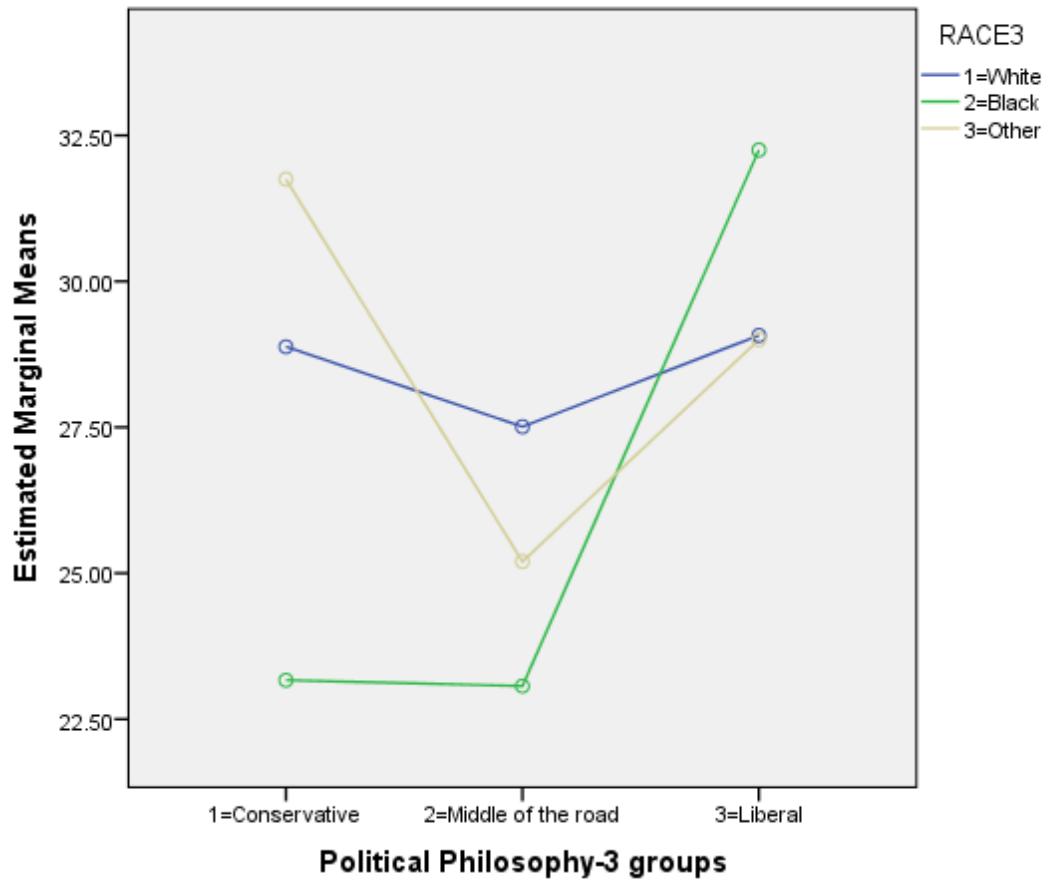
Dependent Variable: COMPUTE SocialCurrency=Mean(c64,c65,c66,c67)\*4



Model: Intercept + RACE3 + PoIPhil3 + RACE3 \* PoIPhil3

## Profile Plots

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



## IV. TABLING RESULTS

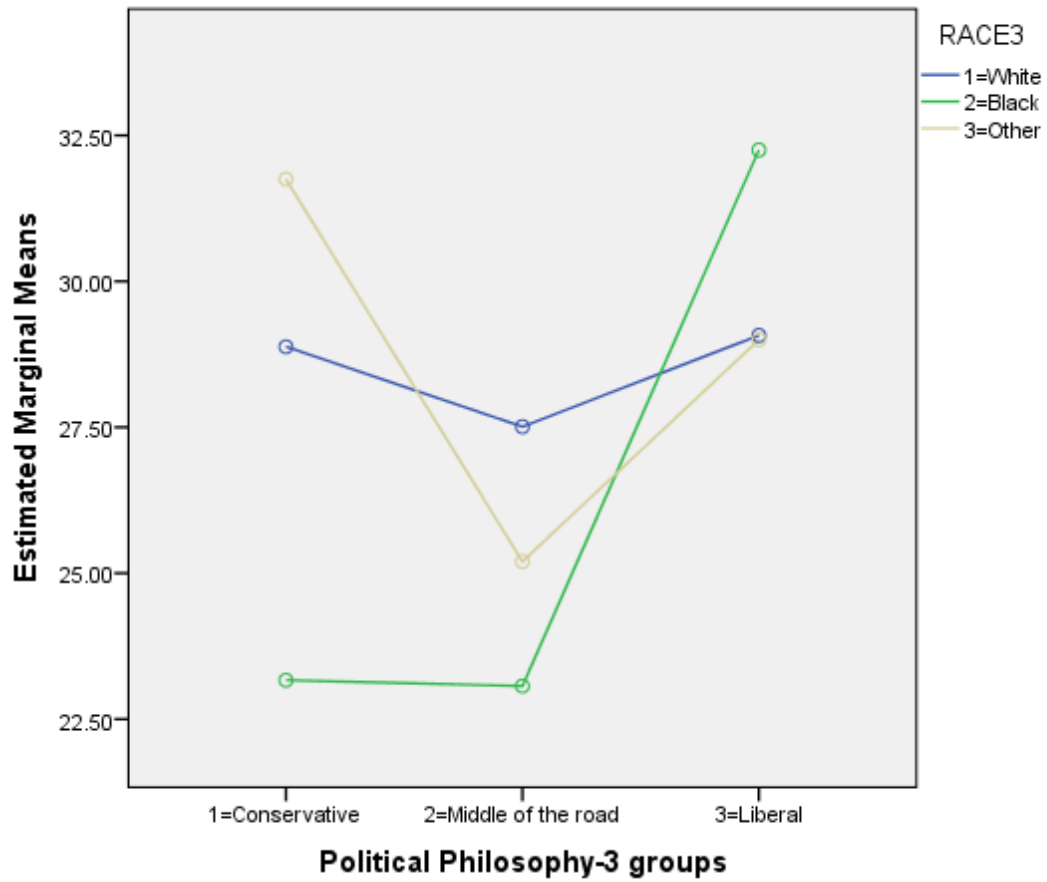
Table 1.  
Two-Factor ANOVA Predicting Social Currency Humor Appreciation from Race and Political Philosophy

	Mean	<i>sd</i>	<i>n</i>	Sum of Squares	<i>df</i>	Mean Square	F	Sig.	Partial 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				

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  $\eta^2$  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. Among liberals, all three races have a relatively high appreciation of social currency humor, with small or negligible differences among the races.