TWO-FACTOR ANOVA
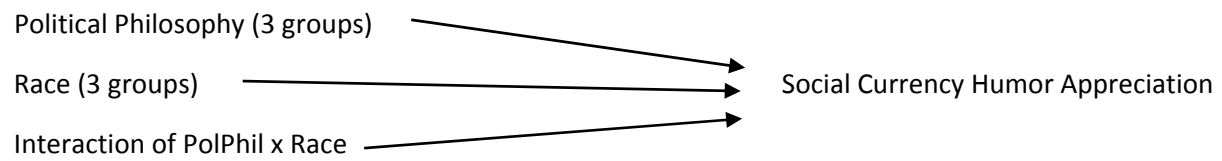
Kim Neuendorf

4/12/16

COM 631/731

I. MODEL

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

Political Philosophy (3 groups)

Race (3 groups) → Social Currency Humor Appreciation

Interaction of 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'.
```

Analyze → General Linear Model → Univariate:

Bring over one dependent variable and two independent variables (placed in the Fixed Factor(s) box).

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

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:

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:

Click OK on main window to run.

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\c63116\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		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.

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[a]

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.[a]

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[a]	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[b]
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

					95% Confidence Interval for Difference[a]	
(I) RACE3	(J) RACE3	Mean Difference (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[a]
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.[b]
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*	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[b]	
		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[a]
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
	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 road	1=Conservative	-1.7413	1.31272	.417	-4.9794	1.4967
		3=Liberal	-3.2275*	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*	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 road	1=Conservative	-1.7413	1.31272	.186	-4.3303	.8476
		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
Bonferroni	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

	Political Philosophy-3 groups	N	Subset	
			1	2
Tukey HSD[a,b,c]	2=Middle of the road	62	26.6075	
	1=Conservative	43	28.3488	28.3488
	3=Liberal	99		29.8350
	Sig.		.318	.433
Scheffe[a,b,c]	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.
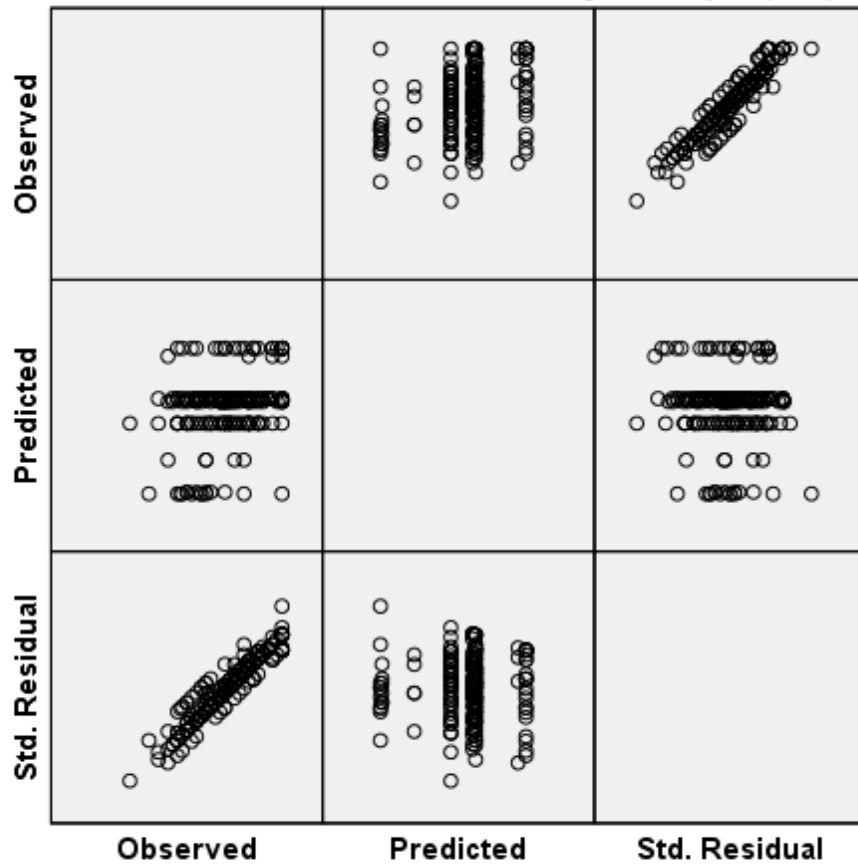
Based on observed means.

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.
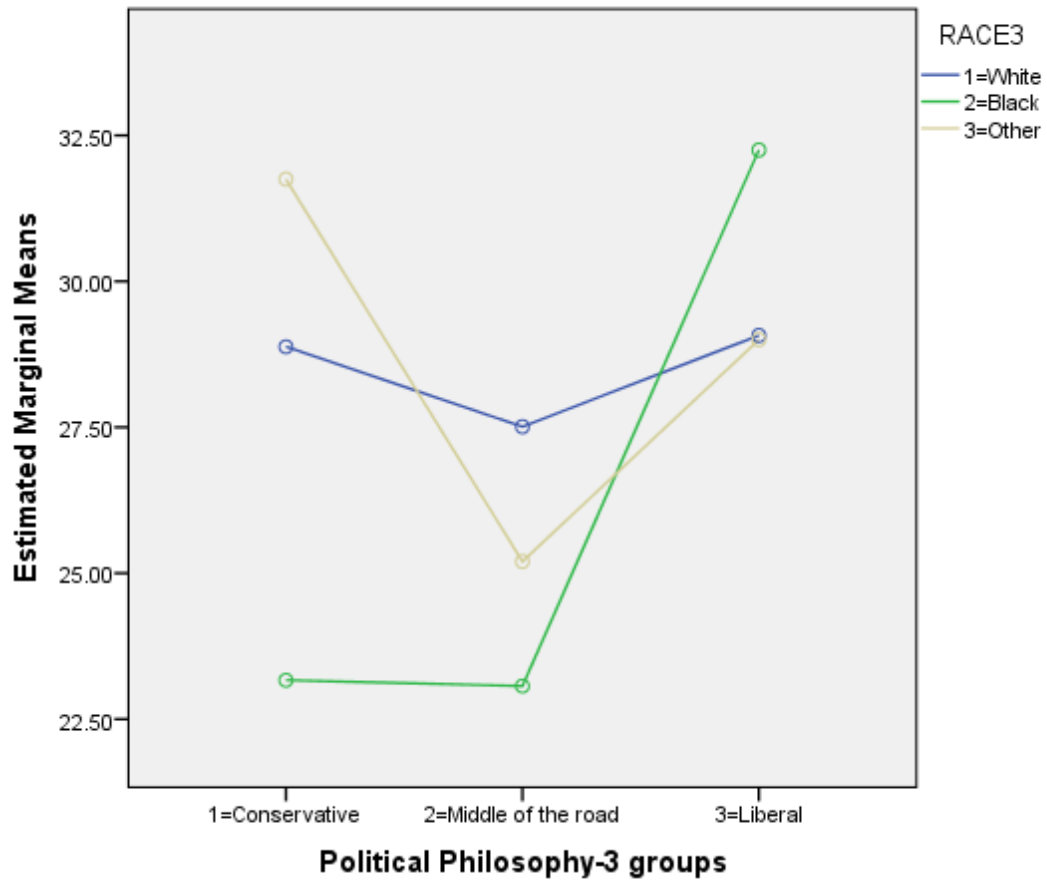
c. Alpha = .05.

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

Model: Intercept + RACE3 + PolPhil3 + RACE3 * PolPhil3

Profile Plots

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

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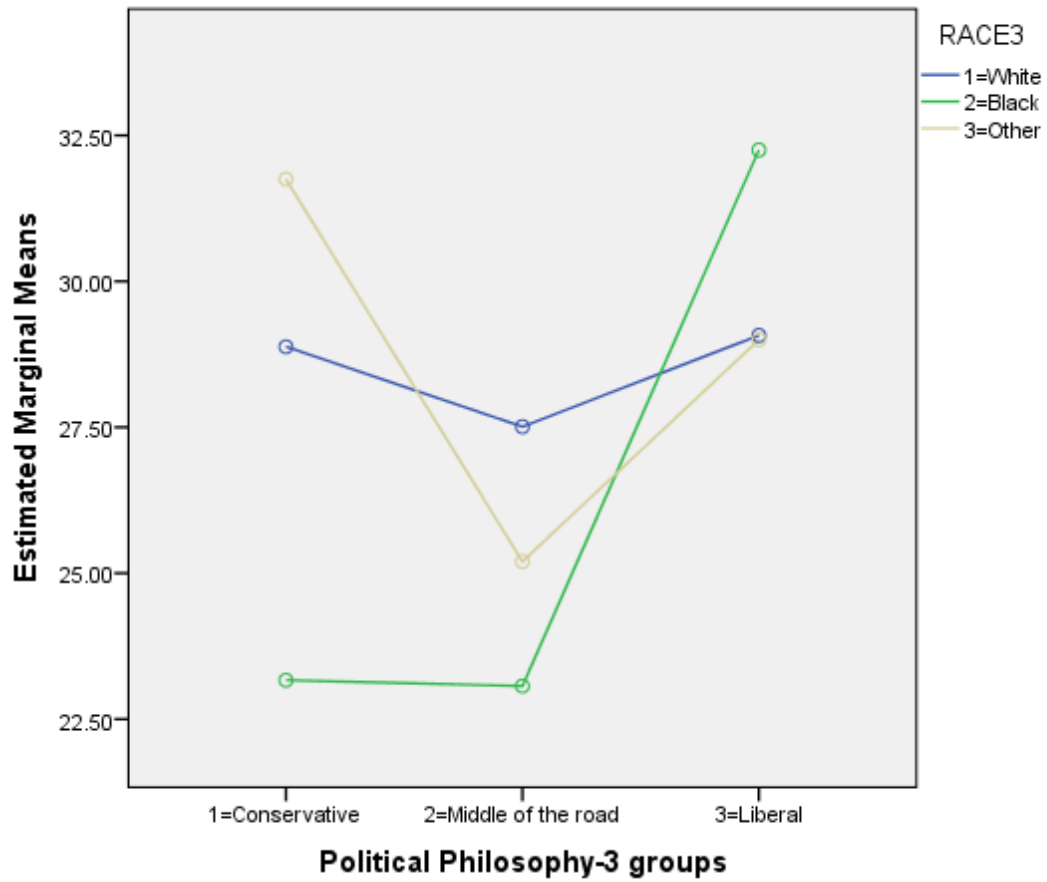
Table 1.
Two-Factor ANOVA Predicting Social Currency Humor Appreciation from Race and Political Philosophy

	Mean	*sd*	*n*	Sum of Squares	*df*	Mean Square	F	Sig.	Partial eta^2
Race				134.76	2	67.38	1.54	.22	.02
White	28.52	6.37	144						
Black	28.59	8.19	40						
Other	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 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.