MANCOVA

COM 631/731

Spring 2017

SHANTALE D. ROBERTS

I. MODEL

From Film and TV Usage data set (Jeffres & Neuendorf, 2015)

COVARIATES

Q29a. "I love the options at my fingertips today…"

Q29e. "I can hardly wait to see what technology comes next."

Q29o. "I generally think of myself as a happy person."

INDEPENDENT VARIABLES

X1: "GENDER"

X2: Q7. "How did you watch this movie 1?"

INTERACTION OF X1 AND X2:

DEPENDENT VARIABLES

Q23a. I often watch a favorite film again and again.

Q23d. I don't like to watch films at home that I've seen before in a theater.

Q23f. I watch TV programs with my family that we've seen before, often several times.

Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.

Independent Variables:

Q7. How did you watch this movie 1? – Nominal (4 Categories)
1 = In a theater, 2 = On TV/cable, 3= DVD/Blu-ray, 4 = Online

Gender - Nominal (2 Categories)
1= Male, 2= Female

Dependent Variables:

(all measured on a 1-7 response scale, where 1=not like me at all and 7=very much like me)

Q23a. I often watch a favorite film again and again.

Q23d. I don't like to watch films at home that I've seen before in a theater.

Q23f. I watch TV programs with my family that we've seen before, often several times.

Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.

Covariates:

(all measured on a 1-7 response scale, where 1=completely disagree and 7=completely agree)

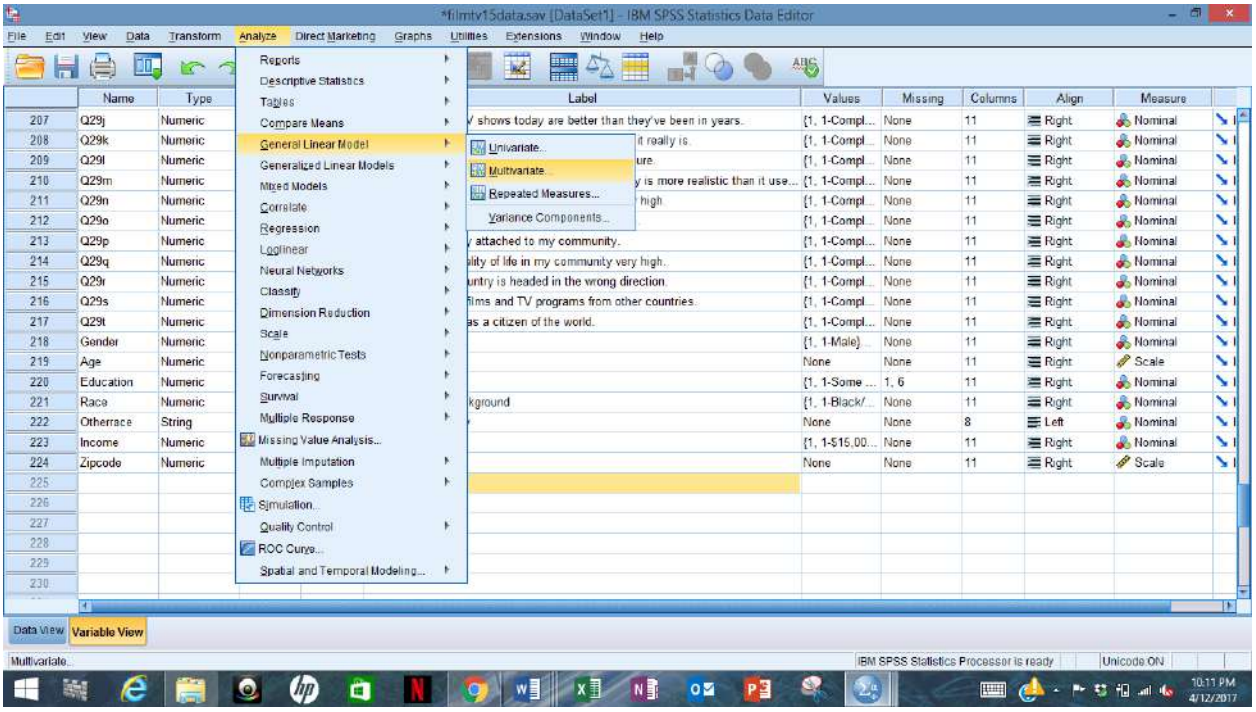
Q29a.I love the options at my fingertips today, watching videos on my phone, texting, streaming films.

Q29e. I can hardly wait to see what technology comes next.

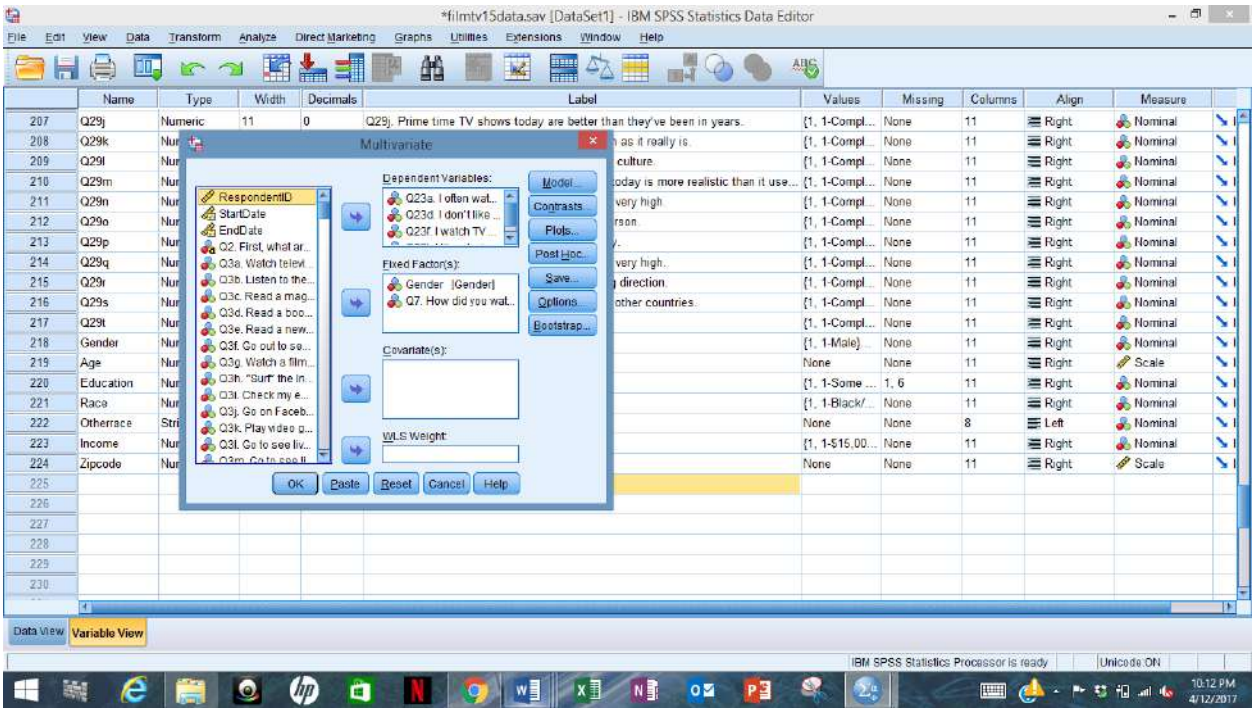
Q29o.I generally think of myself as a happy person.

II. RUNNING SPSS

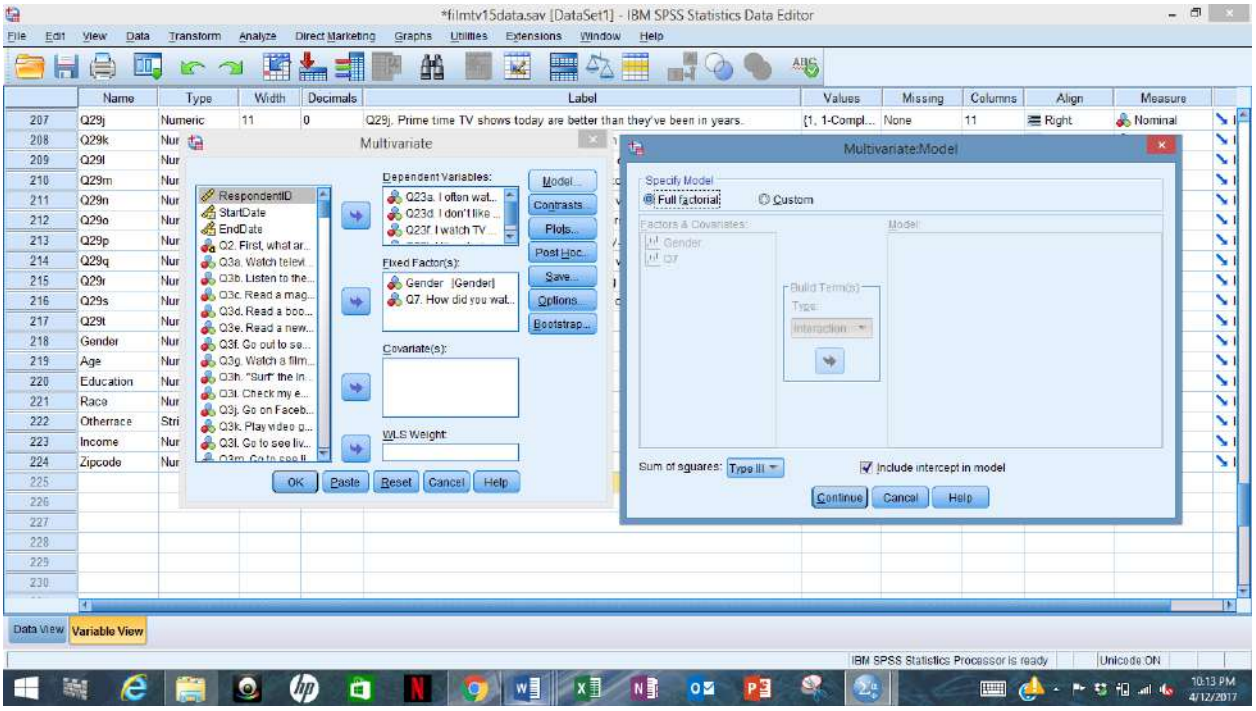
ANALYZE > GENERAL LINEAR MODEL > MULTIVARIATE



> ADD DEPENDENT AND (“FIXED FACTOR”) INDEPENDENT VARIABLES BY CLICKING THE ARROW
(from left boxes to right boxes)



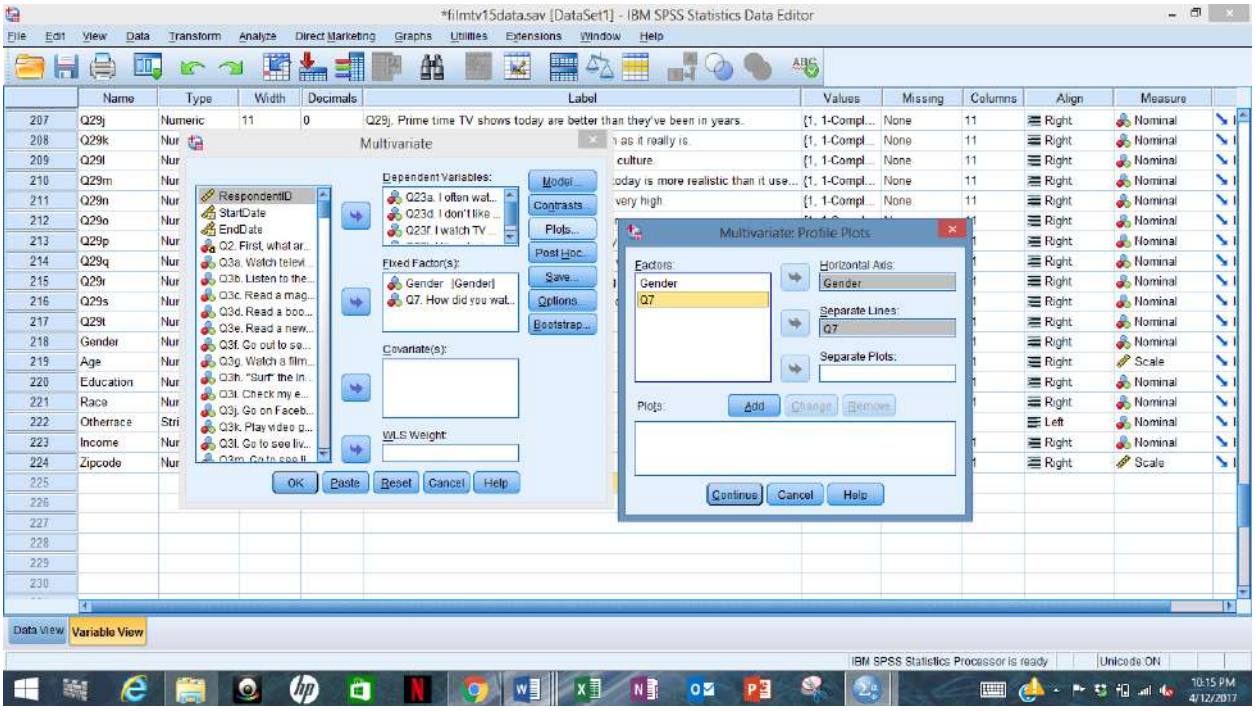
MODEL > √ FULL FACTORIAL > CONTINUE



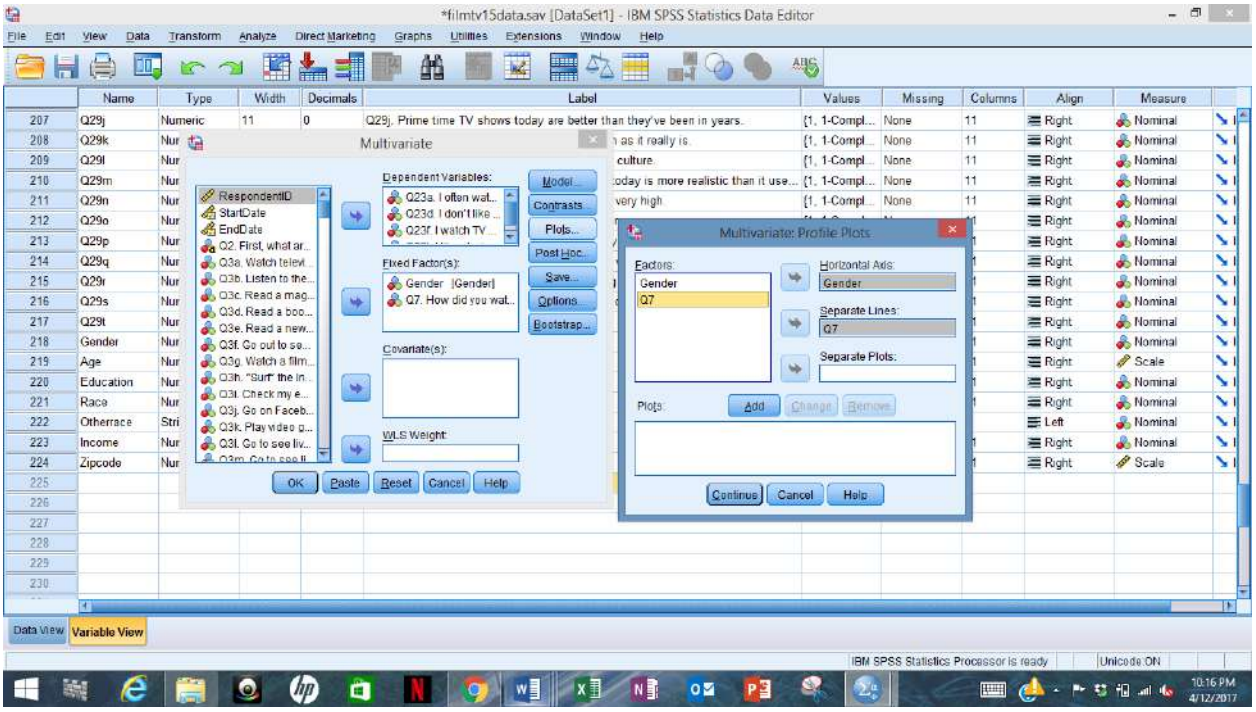
PLOTS > FACTORS > MOVE IV'S INTO RIGHT BOXES USING ARROW KEYS

> √ HORIZONTAL AXIS

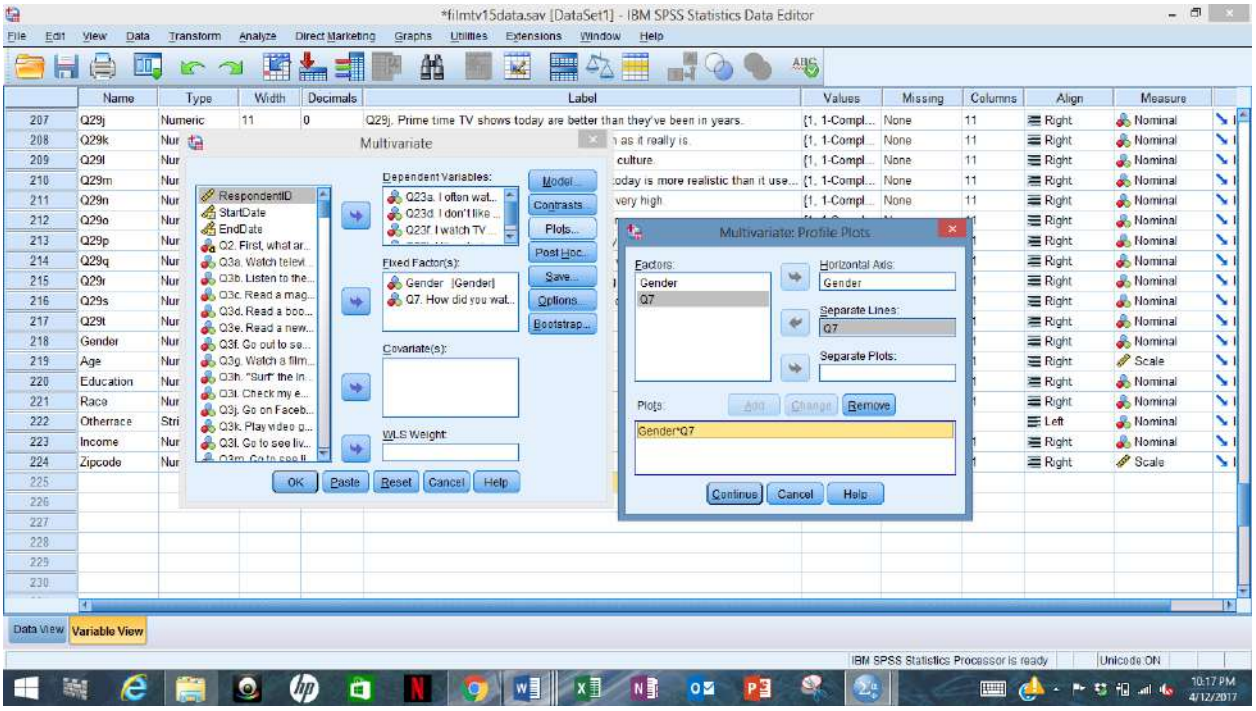
> √ SEPARATE LINES



> ONCE IV'S ARE IN THE BOXES, √ ADD TO CREATE A GRAPH SHOWING THE INTERACTION OF THE IVS



> MAKE SURE THE INTERACTION SHOWS IN THE PLOTS BOX AND THEN CLICK CONTINUE



> OPTIONS

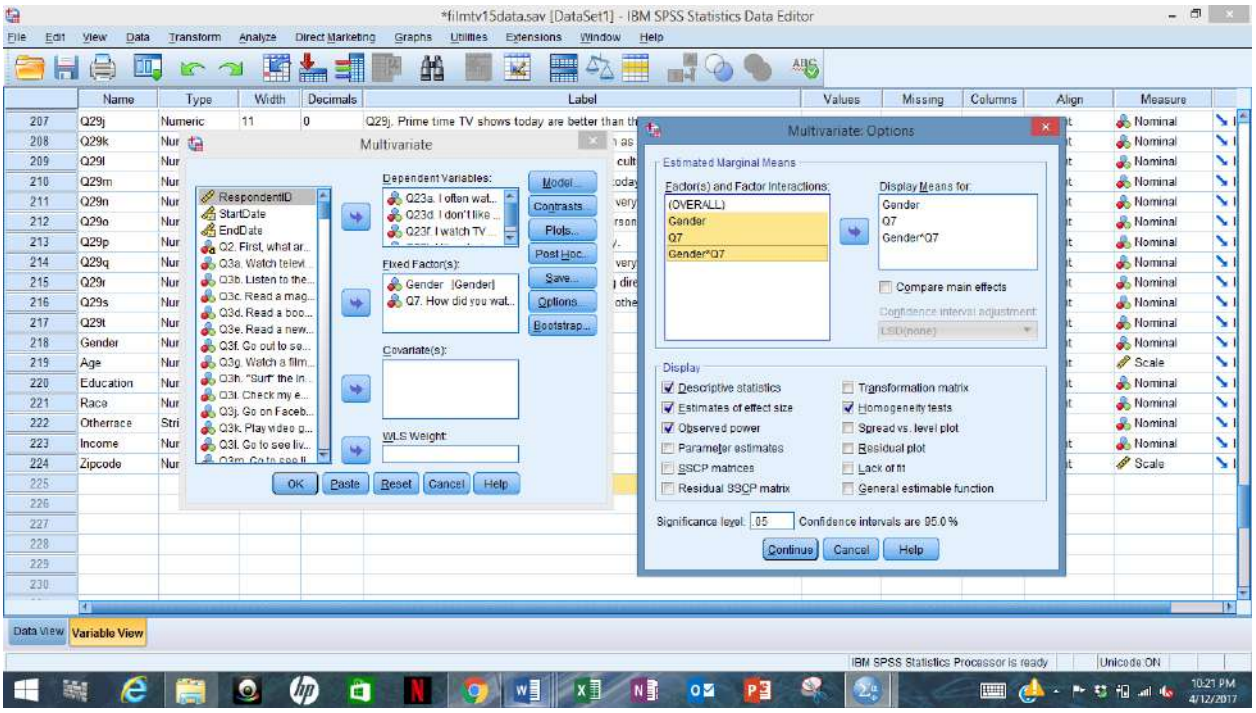
> HIGHLIGHT ALL IVs AND THE INTERACTION IN THE LEFT

√ ARROW TO MOVE IVs TO THE RIGHT BOX

DISPLAY

√ DESCRIPTIVE STATISTICS
√ ESTIMATES OF EFFECT SIZE
√ OBSERVED POWER
√ HOMOGENEITY TESTS

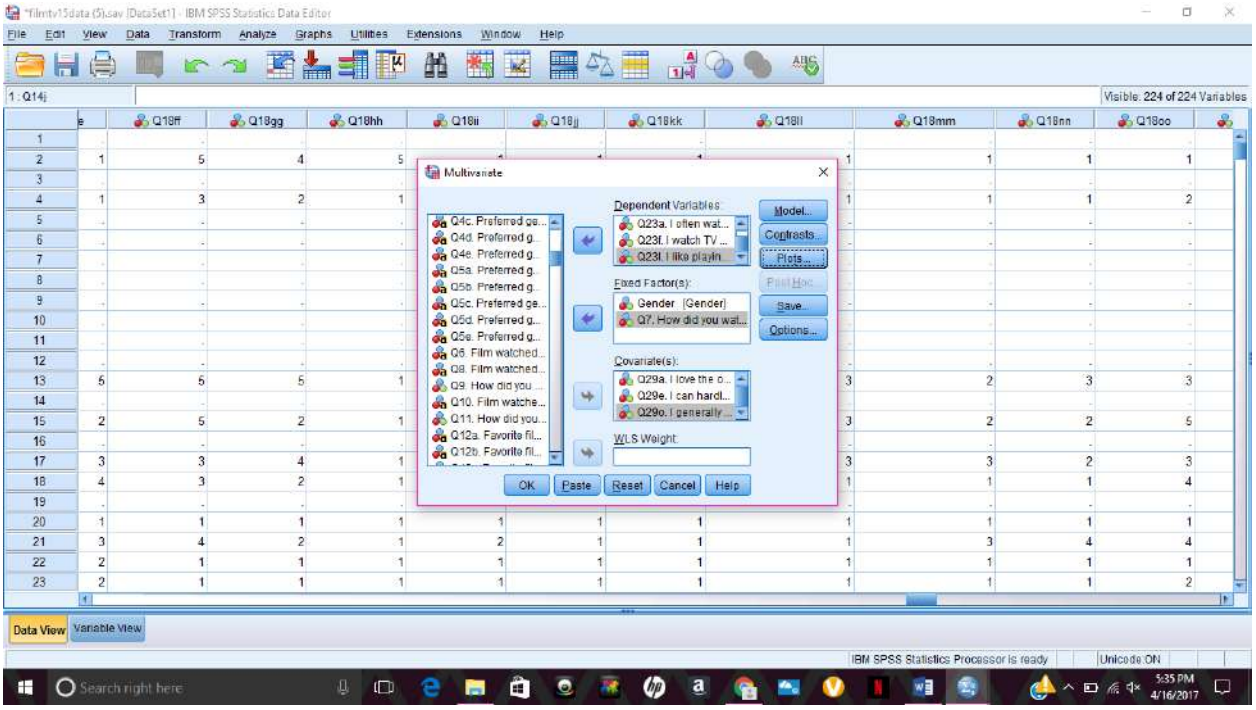
> CONTINUE



>To add COVARIATES, simply insert variables into the “covariate” box.

Everything else is the same EXCEPT there are not any post hoc!

>Hit RUN for MANCOVA!!!! (OR PASTE TO SAVE SYNTAX AND THEN RUN)



III. SPSS OUTPUT

```
DATASET NAME DataSet1 WINDOW=FRONT.
GLM Q23d Q23a Q23f Q23l BY Gender Q7 WITH Q29a Q29e Q29o
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PLOT=PROFILE(Gender*Q7)
  /EMMEANS=TABLES(Gender) WITH(Q29a=MEAN Q29e=MEAN Q29o=MEAN)
  /EMMEANS=TABLES(Q7) WITH(Q29a=MEAN Q29e=MEAN Q29o=MEAN)
  /EMMEANS=TABLES(Gender*Q7) WITH(Q29a=MEAN Q29e=MEAN Q29o=MEAN)
  /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY
  /CRITERIA=ALPHA(.05)
  /DESIGN=Q29a Q29e Q29o Gender Q7 Gender*Q7.
```

General Linear Model

Between-Subjects Factors

		Value Label	N
Gender	1	1-Male	141
	2	2-Female	222
Q7. How did you watch this movie 1	1	1-In theater	85
	2	2-On TV/cable	84
	3	3-DVD or BluRay	90
	4	4-Online	104

Descriptive Statistics

	Gender	Q7. How did you watch this movie 1	Mean	Std. Deviation	N
Q23d. I don't like to watch films at home that I've seen before in a theater.	1-Male	1-In theater	3.07	1.772	42
		2-On TV/cable	2.05	1.433	19
		3-DVD or BluRay	2.70	1.928	33
		4-Online	3.28	2.018	47
		Total	2.91	1.880	141
	2-Female	1-In theater	2.95	2.138	43
		2-On TV/cable	2.06	1.657	65
		3-DVD or BluRay	2.32	1.947	57
		4-Online	2.25	1.562	57
		Total	2.35	1.828	222
	Total	1-In theater	3.01	1.955	85
		2-On TV/cable	2.06	1.601	84
		3-DVD or BluRay	2.46	1.938	90
		4-Online	2.71	1.847	104
		Total	2.57	1.866	363
Q23a. I often watch a favorite film again and again.	1-Male	1-In theater	4.29	1.954	42
		2-On TV/cable	5.58	1.539	19
		3-DVD or BluRay	4.85	1.955	33
		4-Online	4.74	1.916	47
		Total	4.74	1.914	141
	2-Female	1-In theater	4.81	1.955	43
		2-On TV/cable	5.52	1.640	65
		3-DVD or BluRay	5.70	1.546	57
		4-Online	5.12	1.937	57
		Total	5.33	1.781	222
	Total	1-In theater	4.55	1.961	85
		2-On TV/cable	5.54	1.609	84
		3-DVD or BluRay	5.39	1.746	90
		4-Online	4.95	1.928	104
		Total	5.10	1.853	363
Q23f. I watch TV programs with my family that we've seen before, often several times.	1-Male	1-In theater	3.48	1.941	42
		2-On TV/cable	4.32	1.916	19
		3-DVD or BluRay	3.73	1.842	33
		4-Online	2.81	1.569	47
		Total	3.43	1.849	141
	2-Female	1-In theater	3.86	2.088	43
		2-On TV/cable	4.32	1.937	65
		3-DVD or BluRay	4.58	1.963	57
		4-Online	4.14	1.959	57
		Total	4.25	1.982	222
	Total	1-In theater	3.67	2.014	85
		2-On TV/cable	4.32	1.921	84
		3-DVD or BluRay	4.27	1.953	90
		4-Online	3.54	1.905	104
		Total	3.93	1.970	363

Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1-Male	1-In theater	3.76	1.948	42
		2-On TV/cable	4.42	2.009	19
		3-DVD or BluRay	3.27	2.020	33
		4-Online	3.98	2.212	47
		Total	3.81	2.073	141
	2-Female	1-In theater	4.07	2.374	43
		2-On TV/cable	4.75	2.243	65
		3-DVD or BluRay	4.77	2.105	57
		4-Online	4.12	2.330	57
		Total	4.46	2.266	222
	Total	1-In theater	3.92	2.167	85
		2-On TV/cable	4.68	2.185	84
		3-DVD or BluRay	4.22	2.187	90
		4-Online	4.06	2.268	104
		Total	4.21	2.214	363

Box's Test of Equality of Covariance Matrices[a]

Box's M	122.453
F	1.674
df1	70
df2	68591.989
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Q29a + Q29e + Q29o + Gender + Q7 + Gender * Q7

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Intercept	Pillai's Trace	.402	58.572[b]	4.000	349.000	.000	.402	234.290	1.000
	Wilks' Lambda	.598	58.572[b]	4.000	349.000	.000	.402	234.290	1.000
	Hotelling's Trace	.671	58.572[b]	4.000	349.000	.000	.402	234.290	1.000
	Roy's Largest Root	.671	58.572[b]	4.000	349.000	.000	.402	234.290	1.000
Q29a	Pillai's Trace	.028	2.527[b]	4.000	349.000	.041	.028	10.107	.715
	Wilks' Lambda	.972	2.527[b]	4.000	349.000	.041	.028	10.107	.715
	Hotelling's Trace	.029	2.527[b]	4.000	349.000	.041	.028	10.107	.715
	Roy's Largest Root	.029	2.527[b]	4.000	349.000	.041	.028	10.107	.715
Q29e	Pillai's Trace	.031	2.770[b]	4.000	349.000	.027	.031	11.081	.759
	Wilks' Lambda	.969	2.770[b]	4.000	349.000	.027	.031	11.081	.759
	Hotelling's Trace	.032	2.770[b]	4.000	349.000	.027	.031	11.081	.759
	Roy's Largest Root	.032	2.770[b]	4.000	349.000	.027	.031	11.081	.759
Q29o	Pillai's Trace	.018	1.608[b]	4.000	349.000	.172	.018	6.434	.495
	Wilks' Lambda	.982	1.608[b]	4.000	349.000	.172	.018	6.434	.495
	Hotelling's Trace	.018	1.608[b]	4.000	349.000	.172	.018	6.434	.495
	Roy's Largest Root	.018	1.608[b]	4.000	349.000	.172	.018	6.434	.495
Gender	Pillai's Trace	.031	2.762[b]	4.000	349.000	.028	.031	11.050	.758
	Wilks' Lambda	.969	2.762[b]	4.000	349.000	.028	.031	11.050	.758
	Hotelling's Trace	.032	2.762[b]	4.000	349.000	.028	.031	11.050	.758
	Roy's Largest Root	.032	2.762[b]	4.000	349.000	.028	.031	11.050	.758
Q7	Pillai's Trace	.071	2.140	12.000	1053.000	.013	.024	25.682	.946
	Wilks' Lambda	.929	2.162	12.000	923.659	.012	.024	22.841	.912
	Hotelling's Trace	.075	2.179	12.000	1043.000	.011	.024	26.150	.950
	Roy's Largest Root	.063	5.508[c]	4.000	351.000	.000	.059	22.033	.976
Gender * Q7	Pillai's Trace	.055	1.647	12.000	1053.000	.073	.018	19.769	.857
	Wilks' Lambda	.945	1.649	12.000	923.659	.073	.019	17.428	.797
	Hotelling's Trace	.057	1.648	12.000	1043.000	.073	.019	19.779	.857
	Roy's Largest Root	.037	3.217[c]	4.000	351.000	.013	.035	12.869	.827

a. Design: Intercept + Q29a + Q29e + Q29o + Gender + Q7 + Gender * Q7

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha = .05

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

	F	df1	df2	Sig.
Q23d. I don't like to watch films at home that I've seen before in a theater.	2.618	7	355	.012
Q23a. I often watch a favorite film again and again.	.971	7	355	.452
Q23f. I watch TV programs with my family that we've seen before, often several times.	1.058	7	355	.390
Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	2.034	7	355	.050

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

a. Design: Intercept + Q29a + Q29e + Q29o + Gender + Q7 + Gender * Q7

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	Q23d. I don't like to watch films at home that I've seen before in a theater.	85.839[a]	10	8.584	2.571	.005	.068	25.710	.956
	Q23a. I often watch a favorite film again and again.	113.729[b]	10	11.373	3.544	.000	.091	35.443	.994
	Q23f. I watch TV programs with my family that we've seen before, often several times.	142.765[c]	10	14.276	3.980	.000	.102	39.804	.998
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	199.832[d]	10	19.983	4.468	.000	.113	44.682	.999
Intercept	Q23d. I don't like to watch films at home that I've seen before in a theater.	131.495	1	131.495	39.384	.000	.101	39.384	1.000
	Q23a. I often watch a favorite film again and again.	299.661	1	299.661	93.387	.000	.210	93.387	1.000
	Q23f. I watch TV programs with my family that we've seen before, often several times.	150.102	1	150.102	41.850	.000	.106	41.850	1.000
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	113.175	1	113.175	25.306	.000	.067	25.306	.999
Q29a	Q23d. I don't like to watch films at home that I've seen before in a theater.	.012	1	.012	.004	.953	.000	.004	.050
	Q23a. I often watch a favorite film again and again.	6.931	1	6.931	2.160	.143	.006	2.160	.311
	Q23f. I watch TV programs with my family that we've seen before, often several times.	.608	1	.608	.170	.681	.000	.170	.070
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	38.856	1	38.856	8.688	.003	.024	8.688	.836
Q29e	Q23d. I don't like to watch films at home that I've seen before in a theater.	8.577	1	8.577	2.569	.110	.007	2.569	.359
	Q23a. I often watch a favorite film again and again.	2.694	1	2.694	.839	.360	.002	.839	.150
	Q23f. I watch TV programs with my family that we've seen before, often several times.	7.680	1	7.680	2.141	.144	.006	2.141	.309
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	23.375	1	23.375	5.227	.023	.015	5.227	.626
Q29o	Q23d. I don't like to watch films at home that I've seen before in a theater.	4.426	1	4.426	1.326	.250	.004	1.326	.209
	Q23a. I often watch a favorite film again and again.	10.636	1	10.636	3.315	.070	.009	3.315	.443
	Q23f. I watch TV programs with my family that we've seen before, often several times.	13.342	1	13.342	3.720	.055	.010	3.720	.486
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	.101	1	.101	.023	.880	.000	.023	.053
Gender	Q23d. I don't like to watch films at home that I've seen before in a theater.	7.338	1	7.338	2.198	.139	.006	2.198	.316
	Q23a. I often watch a favorite film again and again.	10.236	1	10.236	3.190	.075	.009	3.190	.429
	Q23f. I watch TV programs with my family that we've seen before, often several times.	29.450	1	29.450	8.211	.004	.023	8.211	.816
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	22.197	1	22.197	4.963	.027	.014	4.963	.603
Q7	Q23d. I don't like to watch films at home that I've seen before in a theater.	36.367	3	12.122	3.631	.013	.030	10.892	.795
	Q23a. I often watch a favorite film again and again.	47.351	3	15.784	4.919	.002	.040	14.756	.909
	Q23f. I watch TV programs with my family that we've seen before, often several times.	39.049	3	13.016	3.629	.013	.030	10.887	.795
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	19.041	3	6.347	1.419	.237	.012	4.258	.376
Gender * Q7	Q23d. I don't like to watch films at home that I've seen before in a theater.	14.454	3	4.818	1.443	.230	.012	4.329	.382
	Q23a. I often watch a favorite film again and again.	8.190	3	2.730	.851	.467	.007	2.553	.235
	Q23f. I watch TV programs with my family that we've seen before, often several times.	22.160	3	7.387	2.059	.105	.017	6.178	.526
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	31.094	3	10.365	2.318	.075	.019	6.953	.581

Error	Q23d. I don't like to watch films at home that I've seen before in a theater.	1176.267	362	3.339					
	Q23a. I often watch a favorite film again and again.	1129.499	362	3.209					
	Q23f. I watch TV programs with my family that we've seen before, often several times.	1262.514	362	3.587					
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1574.267	362	4.472					
Total	Q23d. I don't like to watch films at home that I've seen before in a theater.	3654.000	363						
	Q23a. I often watch a favorite film again and again.	10692.000	363						
	Q23f. I watch TV programs with my family that we've seen before, often several times.	7016.000	363						
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	8206.000	363						
Corrected Total	Q23d. I don't like to watch films at home that I've seen before in a theater.	1261.096	362						
	Q23a. I often watch a favorite film again and again.	1243.229	362						
	Q23f. I watch TV programs with my family that we've seen before, often several times.	1405.278	362						
	Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1774.088	362						

a. R Squared = .068 (Adjusted R Squared = .042)
b. R Squared = .091 (Adjusted R Squared = .066)
c. R Squared = .102 (Adjusted R Squared = .076)
d. R Squared = .113 (Adjusted R Squared = .087)
e. Computed using alpha = .05

Estimated Marginal Means

1. Gender

Dependent Variable	Gender	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Q23d. I don't like to watch films at home that I've seen before in a theater.	1-Male	2.729[a]	.167	2.401	3.058
	2-Female	2.417[a]	.125	2.171	2.662
Q23a. I often watch a favorite film again and again.	1-Male	4.900[a]	.164	4.579	5.222
	2-Female	5.270[a]	.123	5.029	5.511
Q23f. I watch TV programs with my family that we've seen before, often several times.	1-Male	3.590[a]	.173	3.250	3.930
	2-Female	4.217[a]	.130	3.962	4.471
Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1-Male	3.877[a]	.193	3.497	4.257
	2-Female	4.421[a]	.145	4.136	4.705

a. Covariates appearing in the model are evaluated at the following values: Q29a. I love the options at my finger tips today, watching videos on my phone, texting, streaming films. = 5.15, Q29e. I can hardly wait to see what technology comes next. = 4.41, Q29o. I generally think of myself as a happy person. = 5.23.

2. Q7. How did you watch this movie 1

Dependent Variable	Q7. How did you watch this movie 1	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Q23d. I don't like to watch films at home that I've seen before in a theater.	1-In theater	2.992[a]	.200	2.599	3.385
	2-On TV/cable	2.019[a]	.240	1.547	2.490
	3-DVD or BluRay	2.503[a]	.201	2.107	2.899
	4-Online	2.778[a]	.183	2.419	3.137
Q23a. I often watch a favorite film again and again.	1-In theater	4.526[a]	.196	4.141	4.911
	2-On TV/cable	5.583[a]	.235	5.120	6.045
	3-DVD or BluRay	5.316[a]	.197	4.928	5.704
	4-Online	4.916[a]	.179	4.564	5.268
Q23f. I watch TV programs with my family that we've seen before, often several times.	1-In theater	3.623[a]	.207	3.215	4.030
	2-On TV/cable	4.333[a]	.248	3.844	4.821
	3-DVD or BluRay	4.170[a]	.209	3.760	4.580
	4-Online	3.488[a]	.189	3.116	3.860
Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1-In theater	3.887[a]	.231	3.432	4.342
	2-On TV/cable	4.596[a]	.277	4.051	5.142
	3-DVD or BluRay	4.104[a]	.233	3.646	4.562
	4-Online	4.008[a]	.211	3.592	4.424

a. Covariates appearing in the model are evaluated at the following values: Q29a. I love the options at my finger tips today, watching videos on my phone, texting, streaming films. = 5.15, Q29e. I can hardly wait to see what technology comes next. = 4.41, Q29o. I generally think of myself as a happy person. = 5.23.

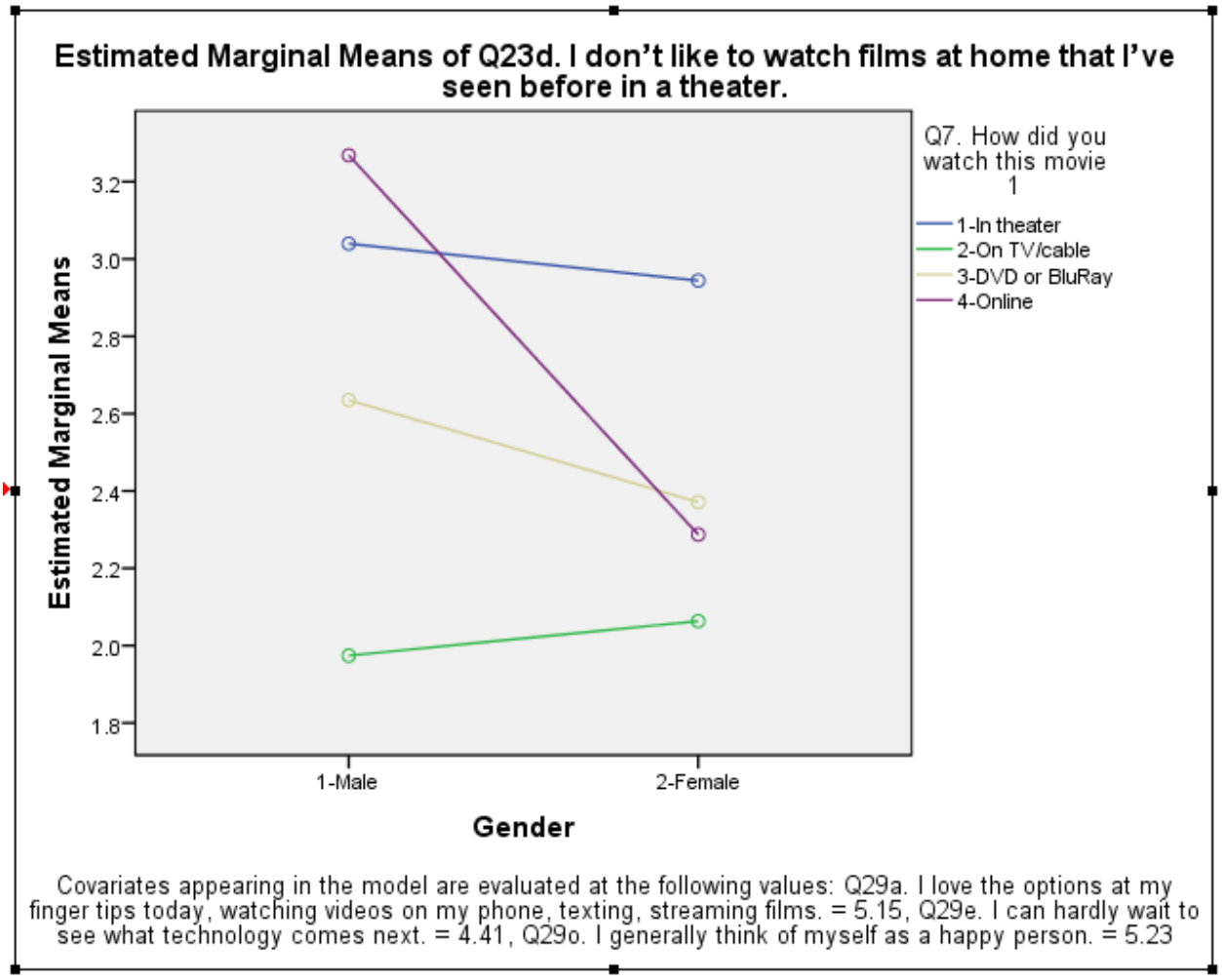
3. Gender * Q7. How did you watch this movie 1

Dependent Variable	Gender	Q7. How did you watch this movie 1	Mean	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
Q23d. I don't like to watch films at home that I've seen before in a theater.	1-Male	1-In theater	3.040[a]	.284	2.480	3.599
		2-On TV/cable	1.974[a]	.424	1.140	2.809
		3-DVD or BluRay	2.635[a]	.321	2.003	3.267
		4-Online	3.268[a]	.267	2.743	3.794
	2-Female	1-In theater	2.944[a]	.280	2.393	3.495
		2-On TV/cable	2.063[a]	.228	1.616	2.511
		3-DVD or BluRay	2.371[a]	.244	1.892	2.851
		4-Online	2.287[a]	.246	1.804	2.771
Q23a. I often watch a favorite film again and again.	1-Male	1-In theater	4.318[a]	.279	3.770	4.866
		2-On TV/cable	5.657[a]	.416	4.839	6.475
		3-DVD or BluRay	4.902[a]	.315	4.282	5.522
		4-Online	4.726[a]	.262	4.210	5.241
	2-Female	1-In theater	4.734[a]	.275	4.194	5.275
		2-On TV/cable	5.508[a]	.223	5.069	5.947
		3-DVD or BluRay	5.730[a]	.239	5.259	6.200
		4-Online	5.107[a]	.241	4.633	5.581
Q23f. I watch TV programs with my family that we've seen before, often several times.	1-Male	1-In theater	3.473[a]	.295	2.893	4.052
		2-On TV/cable	4.335[a]	.440	3.470	5.200
		3-DVD or BluRay	3.743[a]	.333	3.088	4.398
		4-Online	2.810[a]	.277	2.265	3.354
	2-Female	1-In theater	3.772[a]	.290	3.201	4.343
		2-On TV/cable	4.330[a]	.236	3.866	4.794
		3-DVD or BluRay	4.597[a]	.253	4.100	5.095
		4-Online	4.167[a]	.255	3.665	4.668
Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.	1-Male	1-In theater	3.806[a]	.329	3.159	4.453
		2-On TV/cable	4.487[a]	.491	3.521	5.453
		3-DVD or BluRay	3.302[a]	.372	2.571	4.034
		4-Online	3.912[a]	.309	3.304	4.521
	2-Female	1-In theater	3.968[a]	.324	3.331	4.606
		2-On TV/cable	4.706[a]	.263	4.187	5.224
		3-DVD or BluRay	4.906[a]	.282	4.350	5.461
		4-Online	4.104[a]	.285	3.544	4.664

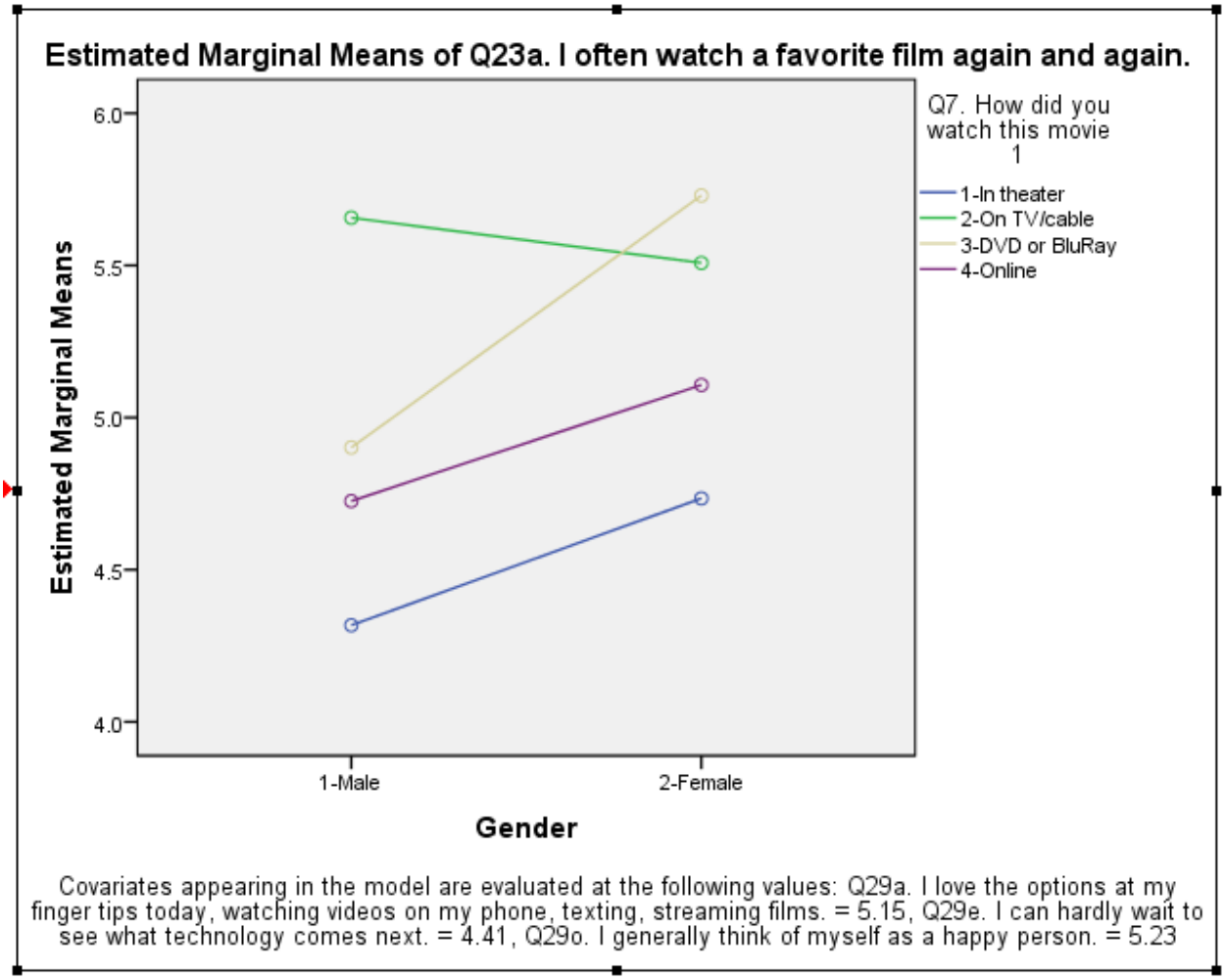
a. Covariates appearing in the model are evaluated at the following values: Q29a. I love the options at my finger tips today, watching videos on my phone, texting, streaming films. = 5.15, Q29e. I can hardly wait to see what technology comes next. = 4.41, Q29o. I generally think of myself as a happy person. = 5.23.

Profile Plots

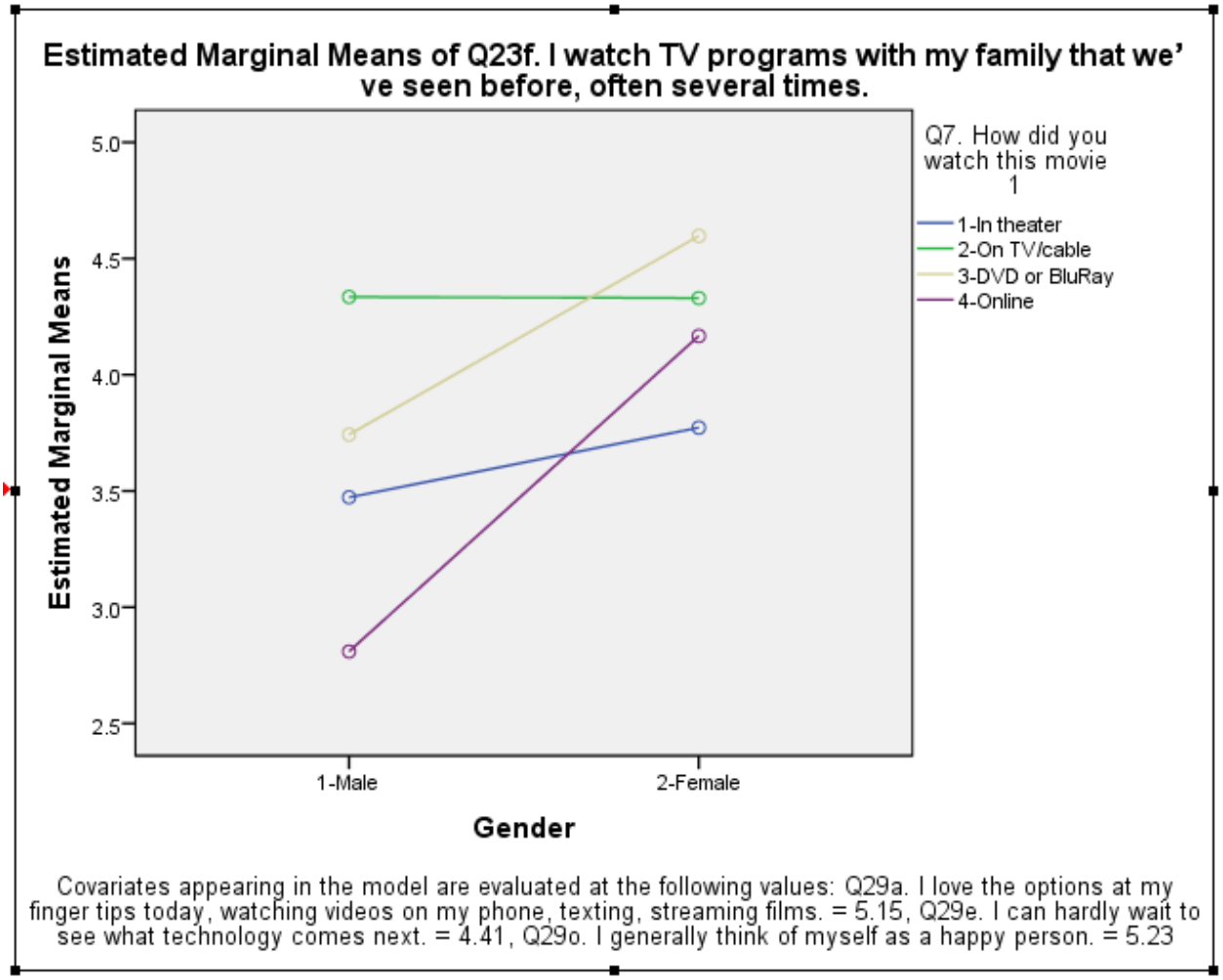
Q23d. I don’t like to watch films at home that I’ve seen before in a theater.



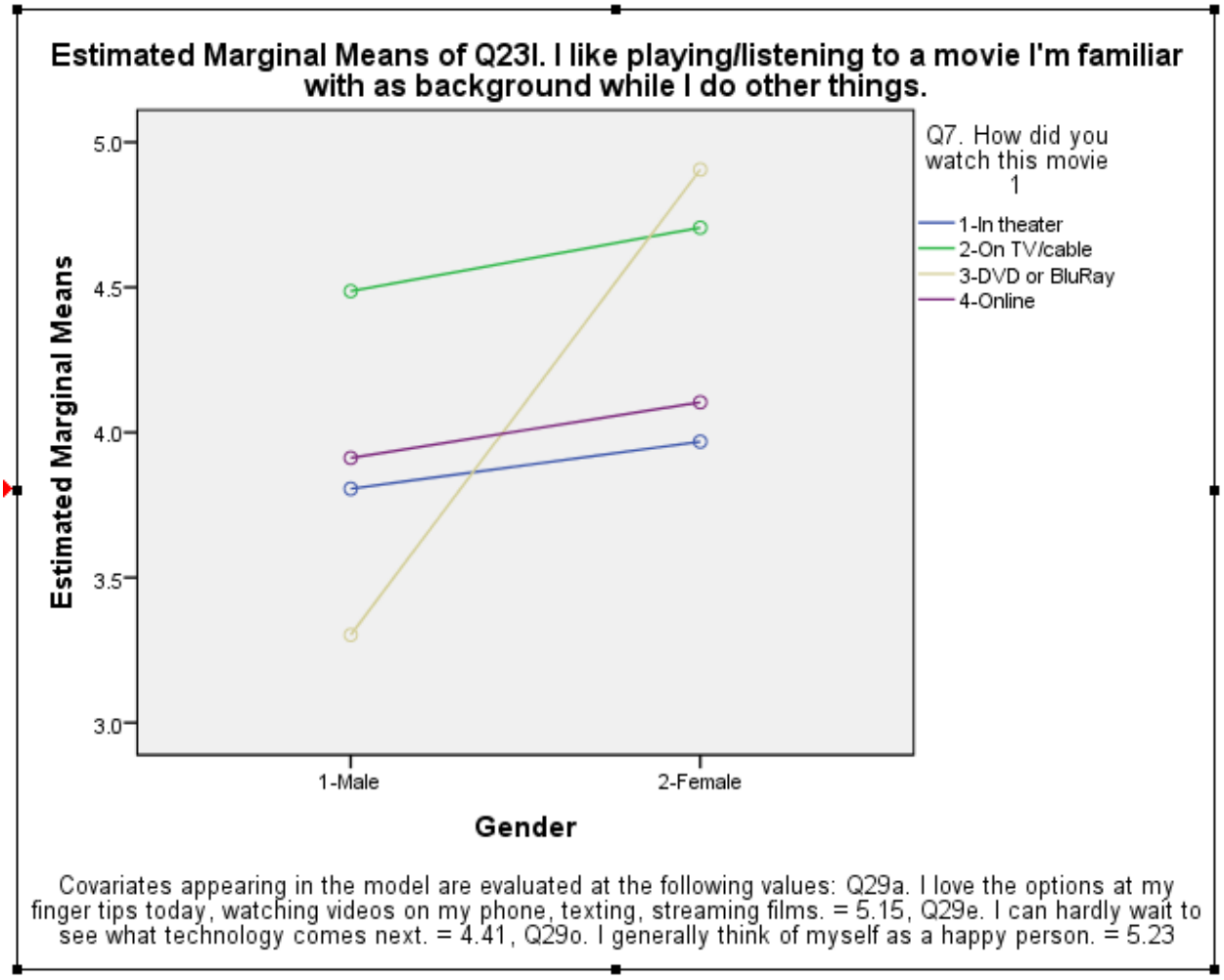
Q23a. I often watch a favorite film again and again.



Q23f. I watch TV programs with my family that we've seen before, often several times.



Q23l. I like playing/listening to a movie I'm familiar with as background while I do other things.



IV. TABLING RESULTS

Table 1. Multivariate Tests for MANCOVA

Effect		Value	F-Value	Sig.	Observed Power
Covariate: Q29a. I love the options at my finger tips	Pillai's Trace	.402	58.572^{b}	.041	.715
	Wilk's Lambda	.598	58.572^{b}	.041	.715
	Hotelling's Trace	.671	58.572^{b}	.041	.715
	Roy's Largest Root	.671	58.572^{b}	.041	.715
Covariate: Q29e. I can hardly wait to see what technology comes next	Pillai's Trace	.031	2.770^{b}	.027	.759
	Wilk's Lambda	.969	2.770^{b}	.027	.759
	Hotelling's Trace	.032	2.770^{b}	.027	.759
	Roy's Largest Root	.032	2.770^{b}	.027	.759
Covariate: Q29o. I generally think of myself as a happy person	Pillai's Trace	.018	1.608^{b}	.172	.495
	Wilk's Lambda	.982	1.608^{b}	.172	.495
	Hotelling's Trace	.018	1.608^{b}	.172	.495
	Roy's Largest Root	.018	1.608^{b}	.172	.495
Main Effect: GENDER	Pillai's Trace	.031	$.031^{b}$	.028	.758
	Wilk's Lambda	.969	$.969^{b}$	.028	.758
	Hotelling's Trace	.032	$.032^{b}$	.028	.758
	Roy's Largest Root	.032	$.032^{b}$	.028	.758
Main Effect: Q7. "How do I watch this movie?"	Pillai's Trace	.071	$.071^{b}$	.013	.946
	Wilk's Lambda	.929	$.929^{b}$	.012	.912
	Hotelling's Trace	.075	$.075^{b}$	.011	.950

	Roy's Largest Root	**.063**	**$.063^b$**	**.000**	**.976**
Interaction: Gender X Q7	**Pillai's Trace**	**.055**	**$.055^b$**	**.073**	**.857**
	Wilk's Lambda	**.945**	**$.945^b$**	**.073**	**.797**
	Hotelling's Trace	**.057**	**$.057^b$**	**.073**	**.857**
	Roy's Largest Root	**.037**	**$.037^b$**	**.013**	**.827**

a. Design:Intercept +Q29+Q29e+Q29o+Gender*Q7
b. Exact statistics
c. The statistic is an upper on F that yields a lower bound on the significance level
d. Computed using alpha=.05

Table 2. Two-factor ANCOVA predicting Q23a. "I often watch a favorite film again and again" From Gender and Q7. "How did you watch this movie 1?"

	Mean	n	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta.^{2}
Covariates:								
COV- Q29a			6.931	1	6.931	2.160	.143	.006
COV- Q29e			2.694	1	2.694	.839	.360	.002
COV- Q29o			10.636	1	10.636	3.315	.070	.009
Main Effect: Gender			10.236	1	10.236	3.190	.075	.009
2-Female	5.33	222						
1-Male	4.74	141						
Main Effect: Q7. How did you watch this movie 1?			47.351	3	15.784	4.919	.002	.040
1- In theater	4.55	85						
2- On TV/cable	5.54	84						
3- DVD or Blu-ray	5.39	90						
4- Online	4.95	104						
Interaction: Gender X Q7. How did you watch this movie 1?			8.190	3	2.730	.851	.467	.007
Error			1129.499	352	3.209			

Table 3. Two-factor ANCOVA predicting Q23d. "I don't like to watch films at home that I've seen before in a theater" From Gender and Q7. "How did you watch this movie 1?"

	Mean	n	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta.^{2}
Covariates:								
COV- Q29a			.012	1	.012	.004	.953	.000
COV- Q29e			8.577	1	8.577	2.569	.110	.007
COV- Q29o			4.426	1	4.426	1.326	.250	.004
Main Effect: Gender			7.338	1	7.338	2.198	.139	.006
2-Female	2.35	222						
1-Male	2.95	141						
Main Effect: Q7. How did you watch this movie 1?			36.367	3	12.122	3.631	.013	.030
1- In theater	3.01	85						
2- On TV/cable	2.06	84						
3- DVD or Blu-ray	2.46	90						
4- Online	2.71	104						
Interaction: Gender X Q7. How did you watch this movie 1?			14.454	3	4.818	1.443	.230	.012
Error			1175.257	352	3.339			

Table 4. Two-factor ANCOVA predicting Q23f. "I watch TV programs with my family that we've seen before, often several times" From Gender and Q7. "How did you watch this movie 1?"

	Mean	n	**Sum of Squares**	df	**Mean Square**	**F**	**Sig.**	**Partial Eta.^{2}**
Covariates:								
COV- Q29a			.608	1	.608	.170	.681	.000
COV- Q29e			7.680	1	7.680	2.141	.144	.006
COV- Q29o			13.342	1	13.342	3.720	.055	.010
Main Effect: Gender			29.450	1	29.450	8.211	.004	.023
2-Female	4.25	222						
1-Male	3.43	141						
Main Effect: Q7. How did you watch this movie 1?			39.049	3	13.016	3.629	.013	.030
1- In theater	3.67	85						
2- On TV/cable	4.32	84						
3- DVD or Blu-ray	4.27	90						
4- Online	3.54	104						
Interaction: Gender X Q7. How did you watch this movie 1?			22.160	3	7.387	2.059	.105	.017
Error			1262.515	352	3.587			

Table 5. Two-factor ANCOVA predicting Q23l. "I like playing/listening to a movie I'm familiar with as a background while I do other things" From Gender and Q7. "How did you watch this movie 1?"

	Mean	n	**Sum of Squares**	df	**Mean Square**	**F**	**Sig.**	**Partial Eta.^{2}**
Covariates:								
COV- Q29a			38.856	1	38.856	8.688	.003	.024
COV- Q29e			23.375	1	23.375	5.227	.023	.015
COV- Q29o			.101	1	.101	.023	.880	.000
Main Effect: Gender			22.197	1	22.197	4.963	.027	.014
2-Female	4.46	222						
1-Male	3.81	141						
Main Effect: Q7. How did you watch this movie 1?			19.041	3	6.347	1.419	.237	.012
1- In theater	3.92	85						
2- On TV/cable	4.68	84						
3- DVD or Blu-ray	4.22	90						
4- Online	4.06	104						
Interaction: Gender X Q7. How did you watch this movie 1?			31.094	3	10.365	2.318	.075	.019
Error			1574.257	352	4.472			

V. Write Up

This model was analyzed using MANCOVA and followed the same basic model as this class' MANOVA example. All variables in MANOVA remained the same, but to further test covariates were used. "I love the options at my fingertips", "I can hardly wait to see what technology comes next…", and "I general think of myself as a happy person" were used in the MANCOVA data set as covariates to test statistics of the original MANOVA model after controlling for these three variables. For MANOVA, intercorrelations were run among the dependent variables, to make sure they were all significantly correlated with each other (to justify the use of MANOVA; see the MANOVA example handout).

Covariates Q29a "I love the options at my fingertips" and Q29e "I can hardly wait to see what technology comes next" resulted in significance once added to the overall MANOVA model (p =.041 for Q29a and p = .027 for Q29e). There was no significant relationship between covariate Q29o "I generally think of myself as a happy person" and the set of dependent variables (p = .172). However, the two significant covariates proved to be significant in only one of the individual ANOVAs—the one for Q23l ("I like playing/listening to a movie I'm familiar with as background while I do other things").

Further, the inclusion of the three covariates did *not* change the overall results of the original MANOVA. That is, when controlling for Q29a, Q29e, and Q29o, the findings from the MANOVA still held. And, the results for the four individual ANCOVAs showed that the original results for the four ANOVAs also held after controlling for Q29a, Q29e, and Q29o (although the main effect of Gender on Q23a was reduced to near-significance (p =.075)).

There was a surprising finding regarding the interaction of Gender and "How do you watch this movie 1?" as related to the dependent variable Q23a ("I often watch a favorite

film again and again"). In the original MANOVA model there was a significance of .124 for Pillai's Trace, but when covariates were added the ANCOVA resulted in a significance level of .073 (which is near significant).