W241 Final Project

The Effects of Sexually Explicit Music on Self Esteem

Experiments and Causality

April 14, 2018

Load Packages and Data

```
library(XLConnect) # Used to connect to Excel
library(stargazer)

df <- readWorksheetFromFile("./Results/w241 Final Project_April 7, 2018_09.57.xlsx", sheet="LoadIntoR")

nrow(df)
```

```
## [1] 160
```

Exploratory Analysis

Create a dataframe with only the results from the treatment and control groups. Remove people who did not finish, or who were under 18 since these people were not given the study. Note: Highest possible esteem score (most esteem) = 10. Lowest possible esteem score (least esteem) = 70. The distributions of results are interesting. I suspect if we had more observations we would potentially see normal distributions centered around esteem score 23, but also with a large spike around the lowest score (highest esteem) of 10, which reflects a spike of people who have an overall high self esteem.

```
results = df[df$TreatControl %in% c('Treatment','Control - Music','Control - No Music'), ]

nrow(results)
```

```
## [1] 127
```

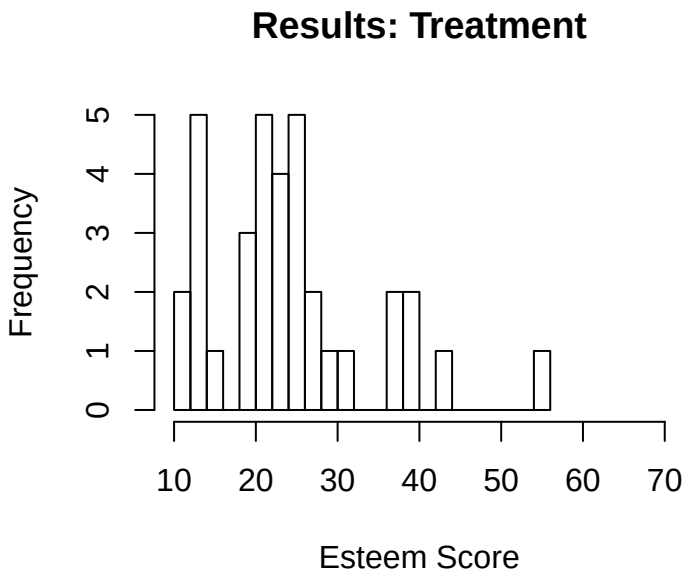
```
# Convert esteem score from character to numeric
results$EsteemScore = as.numeric(results$EsteemScore)

summary(results)
```

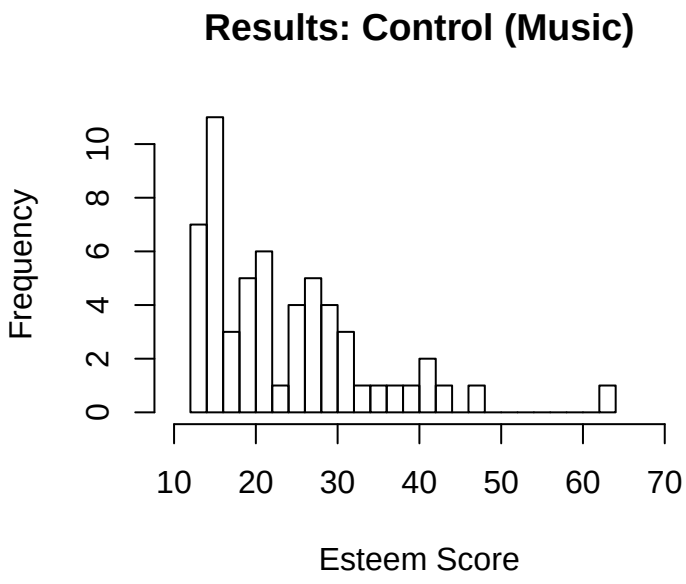
```
##    StartDate                     IPAddress           Finished
##  Min.   :2018-03-14 20:10:53   Length:127         Length:127
##  1st Qu.:2018-03-27 17:36:04   Class :character   Class :character
##  Median :2018-03-27 23:23:18   Mode  :character   Mode  :character
##  Mean   :2018-03-28 12:14:33
##  3rd Qu.:2018-03-29 18:05:16
##  Max.   :2018-04-05 14:27:30
##   ResponseID        LocationLatitude   LocationLongitude
##  Length:127         Length:127         Length:127
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##      Age               Gender           HeardSong
```

```
##  Length:127         Length:127         Length:127
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##    LikeSong         TreatControl        EsteemScore
##  Length:127         Length:127         Min.   :10.00
##  Class :character   Class :character   1st Qu.:16.00
##  Mode  :character   Mode  :character   Median :22.00
##                                        Mean   :23.94
##                                        3rd Qu.:28.00
##                                        Max.   :64.00
```

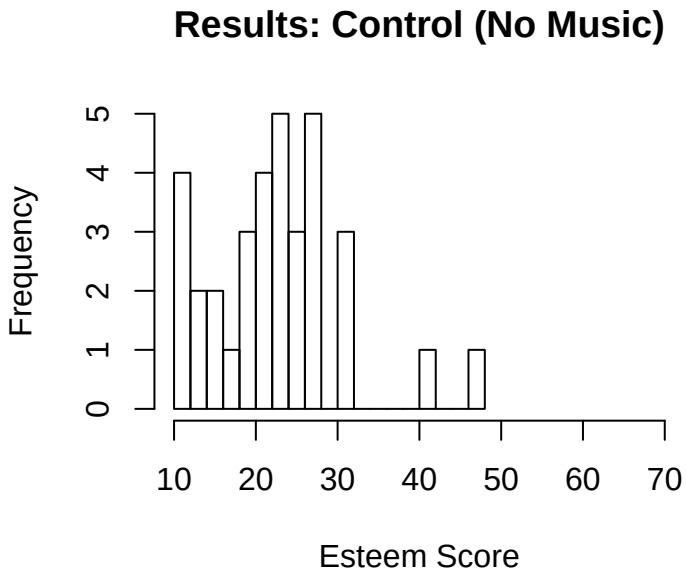
```
hist(results$EsteemScore[results$TreatControl == 'Treatment'], breaks=20,
     main="Results: Treatment", xlab="Esteem Score", xlim=c(10,70))
```




```
hist(results$EsteemScore[results$TreatControl == 'Control - Music'], breaks=20,
     main="Results: Control (Music)", xlab="Esteem Score", xlim=c(10,70))
```




```
hist(results$EsteemScore[results$TreatControl == 'Control - No Music'], breaks=20,
     main="Results: Control (No Music)", xlab="Esteem Score", xlim=c(10,70))
```



Models: Overall

Both of the models below show that our treatment group had lower self esteem (higher score) than both control groups, but the results were not statistically significant. The score of the treatment group is 0.6 larger than the control group with music, and 2.1 larger than the control group with no music.

We included a control group with no music, so we could attempt to ensure that our control song did not have

some type of effect. We did not see a statistically significant difference in the average esteem scores of each control group, and will therefore conclude that our treatment song did not have an effect.

```
# Create new field that contains 1 for treatment and 0 for control groups
results$treat[results$TreatControl == 'Treatment'] <- 1
results$treat[results$TreatControl == 'Control - Music'] <- 0
results$treat[results$TreatControl == 'Control - No Music'] <- 0

# Model 1: Treatment vs. Control (Music)
m1 <- lm(EsteemScore ~ treat, data=results[results$TreatControl %in% c('Treatment','Control - Music'), ])
summary(m1)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat, data = results[results$TreatControl %in%
##     c("Treatment", "Control - Music"), ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -13.771  -8.172  -2.172   4.828  39.828
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   24.172      1.339  18.046   <2e-16 ***
## treat          0.599      2.183   0.274    0.784
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.2 on 91 degrees of freedom
## Multiple R-squared:  0.0008263,  Adjusted R-squared:  -0.01015
## F-statistic: 0.07526 on 1 and 91 DF,  p-value: 0.7844
```

```
# Model 2: Treatment vs. Control (No Music)
m2 <- lm(EsteemScore ~ treat, data=results[results$TreatControl %in% c('Treatment','Control - No Music'), ])
summary(m2)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat, data = results[results$TreatControl %in%
##     c("Treatment", "Control - No Music"), ])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.7714  -5.7714  -0.7714   4.2941  30.2286
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   22.706      1.568  14.485   <2e-16 ***
## treat          2.066      2.201   0.939    0.351
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.14 on 67 degrees of freedom
## Multiple R-squared:  0.01298,    Adjusted R-squared:  -0.001756
## F-statistic: 0.8808 on 1 and 67 DF,  p-value: 0.3514
```

```r
# The difference in esteem score between both control groups is not statistically significant.
t.test(results$EsteemScore[results$TreatControl=='Control - Music'],
       results$EsteemScore[results$TreatControl=='Control - No Music'])
```

```
##
##  Welch Two Sample t-test
##
## data:  results$EsteemScore[results$TreatControl == "Control - Music"] and results$EsteemScore[results
## t = 0.75005, df = 81.94, p-value = 0.4554
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -2.423101  5.356164
## sample estimates:
## mean of x mean of y
##  24.17241  22.70588
```

Models: Controls and Heterogeneous Treatment Effects

The following analyses rely on the treatment group and control group with music. We feel that the control group with music is similar to a placebo because the subjects were subjected to the same conditions as the treatment group, except for the choice of song (the treatment). The control group without music did not have to listen to a song or take a lyrics comprehension quiz. We included this group to help ensure that our control song did not have an effect.

1. Control for gender

```r
results$gen[results$Gender == 'Female'] <- 1
results$gen[results$Gender == 'Male'] <- 0

m3 <- lm(EsteemScore ~ treat + treat*gen, data=results[results$TreatControl %in% c('Treatment','Control
summary(m3)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat + treat * gen, data = results[results$TreatControl %in%
##     c("Treatment", "Control - Music"), ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -13.741  -7.806  -1.806   5.194  38.259
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  25.7407     1.9711  13.059   <2e-16 ***
## treat        -0.3407     3.2982  -0.103    0.918
## gen          -2.9343     2.6961  -1.088    0.279
## treat:gen     1.8343     4.4167   0.415    0.679
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.24 on 89 degrees of freedom
```

```
## Multiple R-squared:  0.01503,    Adjusted R-squared:  -0.01817
## F-statistic: 0.4527 on 3 and 89 DF,  p-value: 0.716
```

2. Control for people who really like a song

```
m4 <- lm(EsteemScore ~ treat + factor(LikeSong), data=results[results$TreatControl %in% c('Treatment','C
summary(m4)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat + factor(LikeSong), data = results[results$TreatControl %in%
##     c("Treatment", "Control - Music"), ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -15.483  -6.928  -1.679   5.033  39.321
##
## Coefficients:
##                                         Estimate Std. Error t value
## (Intercept)                              27.1951     3.8787   7.011
## treat                                     0.2878     2.2718   0.127
## factor(LikeSong)Dislike somewhat         -7.2226     4.4773  -1.613
## factor(LikeSong)Like a great deal        -2.2671     4.7370  -0.479
## factor(LikeSong)Like somewhat            -2.5157     3.9861  -0.631
## factor(LikeSong)Neither like nor dislike -1.6768     4.4046  -0.381
##                                         Pr(>|t|)
## (Intercept)                             4.81e-10 ***
## treat                                      0.899
## factor(LikeSong)Dislike somewhat           0.110
## factor(LikeSong)Like a great deal          0.633
## factor(LikeSong)Like somewhat              0.530
## factor(LikeSong)Neither like nor dislike   0.704
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.21 on 87 degrees of freedom
## Multiple R-squared:  0.04334,    Adjusted R-squared:  -0.01164
## F-statistic: 0.7883 on 5 and 87 DF,  p-value: 0.5609
```

3. Control for different age groups

```
m5 <- lm(EsteemScore ~ treat + factor(Age), data=results[results$TreatControl %in% c('Treatment','Contro
summary(m5)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat + factor(Age), data = results[results$TreatControl %in%
##     c("Treatment", "Control - Music"), ])
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -13.334  -7.002  -2.082   4.913  37.666
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)          26.4641     3.0214   8.759  1.4e-13 ***
## treat                 0.9953     2.2205   0.448   0.6551
## factor(Age)25 - 34   -1.3772     3.1541  -0.437   0.6635
## factor(Age)35 - 44   -0.1304     4.1306  -0.032   0.9749
## factor(Age)45 - 54   -7.4624     4.1169  -1.813   0.0733 .
## factor(Age)55 - 64   -7.8617     4.2090  -1.868   0.0652 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10 on 87 degrees of freedom
## Multiple R-squared:  0.08127,    Adjusted R-squared:  0.02847
## F-statistic: 1.539 on 5 and 87 DF,  p-value: 0.186
```

4. Control for gender and age groups

```
m6 <- lm(EsteemScore ~ treat + treat*gen + factor(Age), data=results[results$TreatControl %in% c('Treatr
summary(m6)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat + treat * gen + factor(Age),
##     data = results[results$TreatControl %in% c("Treatment", "Control - Music"),
##         ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -13.400  -6.805  -1.664   5.195  36.854
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         27.06951    3.45088   7.844 1.16e-11 ***
## treat               -0.19180    3.28849  -0.058   0.9536
## gen                 -1.42659    2.75391  -0.518   0.6058
## factor(Age)25 - 34 -1.26413    3.32736  -0.380   0.7050
## factor(Age)35 - 44  0.07643    4.24927   0.018   0.9857
## factor(Age)45 - 54 -7.07248    4.21269  -1.679   0.0969 .
## factor(Age)55 - 64 -7.69620    4.27691  -1.799   0.0755 .
## treat:gen           2.21304    4.48628   0.493   0.6231
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.1 on 85 degrees of freedom
## Multiple R-squared:  0.08482,    Adjusted R-squared:  0.009456
## F-statistic: 1.125 on 7 and 85 DF,  p-value: 0.3549
```

5. Control for gender and age groups, and if they liked the song

```
m7 <- lm(EsteemScore ~ treat + treat*gen + factor(Age) + factor(LikeSong), data=results[results$TreatCo
summary(m7)
```

```
##
## Call:
## lm(formula = EsteemScore ~ treat + treat * gen + factor(Age) +
##     factor(LikeSong), data = results[results$TreatControl %in%
##     c("Treatment", "Control - Music"), ])
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -13.539  -7.607  -1.582   4.970  36.855
##
## Coefficients:
##                                          Estimate Std. Error t value
## (Intercept)                               32.6879     5.4469   6.001
## treat                                     -0.9425     3.3371  -0.282
## gen                                       -1.7035     2.7679  -0.615
## factor(Age)25 - 34                        -1.5776     3.4068  -0.463
## factor(Age)35 - 44                        -0.4046     4.3413  -0.093
## factor(Age)45 - 54                        -7.2902     4.2732  -1.706
## factor(Age)55 - 64                        -8.8770     4.4786  -1.982
## factor(LikeSong)Dislike somewhat          -8.8734     4.5432  -1.953
## factor(LikeSong)Like a great deal         -4.7958     5.0182  -0.956
## factor(LikeSong)Like somewhat             -5.1379     4.1708  -1.232
## factor(LikeSong)Neither like nor dislike  -3.4628     4.5926  -0.754
## treat:gen                                  2.8709     4.4944   0.639
##                                          Pr(>|t|)
## (Intercept)                              5.26e-08 ***
## treat                                     0.7783
## gen                                       0.5400
## factor(Age)25 - 34                        0.6446
## factor(Age)35 - 44                        0.9260
## factor(Age)45 - 54                        0.0918 .
## factor(Age)55 - 64                        0.0509 .
## factor(LikeSong)Dislike somewhat          0.0543 .
## factor(LikeSong)Like a great deal         0.3421
## factor(LikeSong)Like somewhat             0.2216
## factor(LikeSong)Neither like nor dislike  0.4530
## treat:gen                                 0.5248
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.06 on 81 degrees of freedom
## Multiple R-squared:  0.1346, Adjusted R-squared:  0.01708
## F-statistic: 1.145 on 11 and 81 DF,  p-value: 0.3383
```

Results table. Removed model 2 because it relies on the control group with no music. Saves to html document in local directory

```
stargazer(m1, m3, m4, m5, m6, m7, title="Results: Treatment vs. Control (with Music)", no.space=TRUE, o
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu

% Date and time: Sat, Apr 14, 2018 - 1:40:12 PM

Table 1: Results: Treatment vs. Control (with Music)

	Dependent variable:			
	EsteemScore			
	(1)	(2)	(3)	(4)
treat	0.599	−0.341	0.288	0.995
	(2.184)	(3.298)	(2.272)	(2.221)
gen		−2.934		
		(2.696)		
treat:gen		1.834		
		(4.417)		
factor(LikeSong)Dislike somewhat			−7.223	
			(4.477)	
factor(LikeSong)Like a great deal			−2.267	
			(4.737)	
factor(LikeSong)Like somewhat			−2.516	
			(3.986)	
factor(LikeSong)Neither like nor dislike			−1.677	
			(4.405)	
factor(Age)25 - 34				−1.377
				(3.154)
factor(Age)35 - 44				−0.130
				(4.131)
factor(Age)45 - 54				−7.462*
				(4.117)
factor(Age)55 - 64				−7.862*
				(4.209)
Constant	24.172***	25.741***	27.195***	26.464***
	(1.340)	(1.971)	(3.879)	(3.021)
Observations	93	93	93	93
R^2	0.001	0.015	0.043	0.081
Adjusted R^2	−0.010	−0.018	−0.012	0.028
Residual Std. Error	10.202 (df = 91)	10.242 (df = 89)	10.209 (df = 87)	10.005 (df = 87
F Statistic	0.075 (df = 1; 91)	0.453 (df = 3; 89)	0.788 (df = 5; 87)	1.539 (df = 5; 8

Note:

Analysis of Results

We never found our treatment effect to be statistically significant. However, we did see that subjects in the treatment group had lower self esteem than the subjects in the control group. We also saw that our treatment was associated with lower self esteem in females compared to males. We hypothesized both of these outcomes. We also noticed that older subjects appeared to have higher self esteem compared to younger subjects. Even though the results were not significant, our study could be a worth continuing because we saw effects in the same direction that we hypothesized. Maybe with more data, or an altered experiment, we would see significant effects.