Chapter 9 Lectures Slides

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Using data set from the primary text: ex9.1

```
ex9.1 <- read.csv("~/Dropbox/PSYCH 8710 GLM I/Datasets/ex9.1.txt", sep="")
```

Constructing Helmert codes

```
## One method is to create separate variables for each contrast coded predictor

ex9.1$Lambda1 <- c(rep(5,3),rep(-1,15))
ex9.1$Lambda2 <- c(rep(0,3), rep(4,3), rep(-1,12))
ex9.1$Lambda3 <- c(rep(0,6), rep(3,3), rep(-1,9))
ex9.1$Lambda4 <- c(rep(0,9), rep(2,3), rep(-1,6))
ex9.1$Lambda5 <- c(rep(0,12), rep(1,3), rep(-1,3))

write.table (ex9.1, file = "~/Dropbox/PSYCH 8710 GLM I/R files/ex9.1.text", sep="\t", row.names=FALSE)

## Second method is to construct separate Helmert coded factors for Drug and Psychotherapy
ex9.1$Drug.fH <-factor(ex9.1$Drug)
ex9.1$Psychotherapy.fH <- factor(ex9.1$Psychotherapy)

contrasts(ex9.1$Drug.fH) <- contr.helmert(3)
contrasts(ex9.1$Psychotherapy.fH) <- contr.helmert(2)
```

Testing the omnibus hypothesis that all 6 group means are equal

```
ModelA <- lm(Mood~Lambda1+Lambda2+Lambda3+Lambda4+Lambda5, data = ex9.1)
summary(ModelA)
```

```
##
## Call:
## lm(formula = Mood ~ Lambda1 + Lambda2 + Lambda3 + Lambda4 + Lambda5,
##     data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -3.0   -1.0   -0.5    1.0    4.0
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)  20.0000     0.4811  41.569 2.43e-14 ***
## Lambda1       2.4000     0.2152  11.154 1.09e-07 ***
## Lambda2       2.1000     0.2635   7.969 3.91e-06 ***
## Lambda3       0.5000     0.3402   1.470   0.1674
## Lambda4       1.0000     0.4811   2.078   0.0598 .
## Lambda5       5.0000     0.8333   6.000 6.22e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.041 on 12 degrees of freedom
## Multiple R-squared:  0.9505, Adjusted R-squared:  0.9299
## F-statistic: 46.08 on 5 and 12 DF,  p-value: 2.022e-07
```

```
anova(ModelA)
```

```
## Analysis of Variance Table
##
## Response: Mood
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Lambda1    1  518.4  518.40 124.416 1.087e-07 ***
## Lambda2    1  264.6  264.60  63.504 3.913e-06 ***
## Lambda3    1    9.0    9.00   2.160   0.16737
## Lambda4    1   18.0   18.00   4.320   0.05979 .
## Lambda5    1  150.0  150.00  36.000 6.217e-05 ***
## Residuals 12   50.0    4.17
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
library(lsr)
etaSquared(ModelA, anova=FALSE)
```

```
##              eta.sq eta.sq.part
## Lambda1 0.513267327   0.9120338
## Lambda2 0.261980198   0.8410680
## Lambda3 0.008910891   0.1525424
## Lambda4 0.017821782   0.2647059
## Lambda5 0.148514851   0.7500000
```

```
ModelA2 <- lm(Mood ~ Drug.fH*Psychotherapy.fH, data = ex9.1)
summary(ModelA2)
```

```
##
## Call:
## lm(formula = Mood ~ Drug.fH * Psychotherapy.fH, data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -3.0   -1.0   -0.5    1.0    4.0
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   20.0000     0.4811  41.569 2.43e-14 ***
## Drug.fH1                      -1.0000     0.5893  -1.697  0.11545
## Drug.fH2                      -3.5000     0.3402 -10.288 2.63e-07 ***
## Psychotherapy.fH1              5.0000     0.4811  10.392 2.36e-07 ***
## Drug.fH1:Psychotherapy.fH1    -2.0000     0.5893  -3.394  0.00533 **
```

```
## Drug.fH2:Psychotherapy.fH1  -0.5000     0.3402  -1.470  0.16737
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.041 on 12 degrees of freedom
## Multiple R-squared:  0.9505, Adjusted R-squared:  0.9299
## F-statistic: 46.08 on 5 and 12 DF,  p-value: 2.022e-07
```

```
print(attributes(ex9.1$Drug.fH))
```

```
## $levels
## [1] "DrugA"   "DrugB"   "Placebo"
##
## $class
## [1] "factor"
##
## $contrasts
##         [,1] [,2]
## DrugA     -1   -1
## DrugB      1   -1
## Placebo    0    2
```

```
print(attributes(ex9.1$Psychotherapy.fH))
```

```
## $levels
## [1] "Control"   "Treatment"
##
## $class
## [1] "factor"
##
## $contrasts
##           [,1]
## Control     -1
## Treatment    1
```

Testing the significance of /beta_1

```
ModelC <- lm(Mood~Lambda2+Lambda3+Lambda4+Lambda5, data = ex9.1)
summary(ModelC)
```

```
##
## Call:
## lm(formula = Mood ~ Lambda2 + Lambda3 + Lambda4 + Lambda5, data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -5.4   -3.4   -2.4   -0.4   14.0
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  20.0000     1.5585  12.832 9.31e-09 ***
## Lambda2       2.1000     0.8536   2.460   0.0287 *
```

```
## Lambda3       0.5000     1.1021   0.454   0.6575
## Lambda4       1.0000     1.5585   0.642   0.5323
## Lambda5       5.0000     2.6995   1.852   0.0868 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.612 on 13 degrees of freedom
## Multiple R-squared:  0.4372, Adjusted R-squared:  0.2641
## F-statistic: 2.525 on 4 and 13 DF,  p-value: 0.09156
```

```r
anova(ModelC)
```

```
## Analysis of Variance Table
##
## Response: Mood
##           Df Sum Sq Mean Sq F value  Pr(>F)
## Lambda2    1  264.6 264.600  6.0517 0.02867 *
## Lambda3    1    9.0   9.000  0.2058 0.65753
## Lambda4    1   18.0  18.000  0.4117 0.53227
## Lambda5    1  150.0 150.000  3.4307 0.08683 .
## Residuals 13  568.4  43.723
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Group Means

```r
## grand mean
mean(ex9.1$Mood)
```

```
## [1] 20
```

```r
## mean for Group 1
e1subset <- subset(ex9.1, Lambda1 == 5, select=Mood)
mean(e1subset$Mood)
```

```
## [1] 32
```

```r
## mean for Groups 2-6
e2subset <- subset(ex9.1, Lambda1 == -1, select = Mood)
mean(e2subset$Mood)
```

```
## [1] 17.6
```

```r
## difference between the two
32-17.6
```

```
## [1] 14.4
```

Factorial contrast codes

```r
## One method is to create separate variables for each contrast coded predictor
ex9.1$X1 <- c(rep(1,6),rep(-2,3), rep(1,6),rep(-2,3))
ex9.1$X2 <- c(rep(1,3), rep(-1,3),rep(0,3),rep(1,3),rep(-1,3),rep(0,3))
ex9.1$X3 <- c(rep(1,9), rep(-1,9))
ex9.1$X4 <- c(rep(1,6),rep(-2,3),rep(-1,6),rep(2,3))
ex9.1$X5 <- c(rep(1,3),rep(-1,3),rep(0,3),rep(-1,3),rep(1,3),rep(0,3))

## Second method is to construct separate factors for mood and stop rule
ex9.1$Drug.f <-factor(ex9.1$Drug)
ex9.1$Psychotherapy.f <- factor(ex9.1$Psychotherapy)

contrasts(ex9.1$Drug.f) <- cbind(c(1, 1, -2), c(1, -1, 0))
contrasts(ex9.1$Psychotherapy.f) <- cbind(c(1,-1))
```

Analyses with factorial contrast codes

```r
ModelA2 <- lm(Mood~ X1+X2+X3+X4+X5, data=ex9.1)
summary(ModelA2)
```

```
##
## Call:
## lm(formula = Mood ~ X1 + X2 + X3 + X4 + X5, data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -3.0   -1.0   -0.5    1.0    4.0
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  20.0000     0.4811  41.569 2.43e-14 ***
## X1            3.5000     0.3402  10.288 2.63e-07 ***
## X2            1.0000     0.5893   1.697  0.11545
## X3            5.0000     0.4811  10.392 2.36e-07 ***
## X4            0.5000     0.3402   1.470  0.16737
## X5            2.0000     0.5893   3.394  0.00533 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.041 on 12 degrees of freedom
## Multiple R-squared:  0.9505, Adjusted R-squared:  0.9299
## F-statistic: 46.08 on 5 and 12 DF,  p-value: 2.022e-07
```

```r
anova(ModelA2)
```

```
## Analysis of Variance Table
##
## Response: Mood
##           Df Sum Sq Mean Sq F value    Pr(>F)
## X1         1    441  441.00  105.84 2.633e-07 ***
## X2         1     12   12.00    2.88  0.115447
## X3         1    450  450.00  108.00 2.359e-07 ***
## X4         1      9    9.00    2.16  0.167370
```

```
## X5          1     48   48.00   11.52  0.005327 **
## Residuals 12     50    4.17
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
ModelA2a <- lm(Mood ~ Drug.f*Psychotherapy.f, data = ex9.1)
summary(ModelA2a)
```

```
##
## Call:
## lm(formula = Mood ~ Drug.f * Psychotherapy.f, data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##   -3.0   -1.0   -0.5    1.0    4.0
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)                20.0000     0.4811  41.569 2.43e-14 ***
## Drug.f1                     3.5000     0.3402  10.288 2.63e-07 ***
## Drug.f2                     1.0000     0.5893   1.697  0.11545
## Psychotherapy.f1           -5.0000     0.4811 -10.392 2.36e-07 ***
## Drug.f1:Psychotherapy.f1  -0.5000     0.3402  -1.470  0.16737
## Drug.f2:Psychotherapy.f1  -2.0000     0.5893  -3.394  0.00533 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.041 on 12 degrees of freedom
## Multiple R-squared:  0.9505, Adjusted R-squared:  0.9299
## F-statistic: 46.08 on 5 and 12 DF,  p-value: 2.022e-07
```

Testing the effect of Drug vs. Placebo

```r
ModelC2 <- lm(Mood~ X2+X3+X4+X5, data=ex9.1)
summary(ModelC2)
```

```
##
## Call:
## lm(formula = Mood ~ X2 + X3 + X4 + X5, data = ex9.1)
##
## Residuals:
##    Min     1Q Median     3Q    Max
##  -8.00  -6.00   2.50   3.25   7.50
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   20.000      1.448  13.807 3.82e-09 ***
## X2             1.000      1.774   0.564  0.58257
## X3             5.000      1.448   3.452  0.00429 **
## X4             0.500      1.024   0.488  0.63357
## X5             2.000      1.774   1.127  0.27998
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 6.146 on 13 degrees of freedom
## Multiple R-squared:  0.5139, Adjusted R-squared:  0.3643
## F-statistic: 3.435 on 4 and 13 DF,  p-value: 0.03994
```

```r
anova(ModelC2)
```

```
## Analysis of Variance Table
##
## Response: Mood
##           Df Sum Sq Mean Sq F value   Pr(>F)
## X2         1     12   12.00  0.3177 0.582575
## X3         1    450  450.00 11.9145 0.004294 **
## X4         1      9    9.00  0.2383 0.633575
## X5         1     48   48.00  1.2709 0.279981
## Residuals 13    491   37.77
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Group Means

```r
## constuct Group variable
ex9.1$Group <- c(rep(1,3),rep(2,3),rep(3,3),rep(4,3),rep(5,3),rep(6,3))

## mean for Group 1
e1subset <- subset(ex9.1, Group == 1, select=Mood)
mean(e1subset$Mood)
```

```
## [1] 32
```

```r
## mean for Group 2
e2subset <- subset(ex9.1, Group == 2, select = Mood)
mean(e2subset$Mood)
```

```
## [1] 26
```

```r
## mean for Group 3
e3subset <- subset(ex9.1, Group == 3, select = Mood)
mean(e3subset$Mood)
```

```
## [1] 17
```

```r
## mean for Group 4
e4subset <- subset(ex9.1, Group == 4, select = Mood)
mean(e4subset$Mood)
```

```
## [1] 17
```

```r
## mean for Group 5
e5subset <- subset(ex9.1, Group == 5, select = Mood)
mean(e5subset$Mood)
```

```
## [1] 19
```

```r
## mean for Group 6
e6subset <- subset(ex9.1, Group == 6, select = Mood)
mean(e6subset$Mood)
```

```
## [1] 9
```

```r
## mean for Therapy vs. No Therapy
e7subset <- subset(ex9.1, Group == 1 | Group==2| Group== 3, select = Mood)
mean(e7subset$Mood)
```

```
## [1] 25
```

```r
e8subset <- subset(ex9.1, Group == 4 | Group==5| Group== 6, select = Mood)
mean(e8subset$Mood)
```

```
## [1] 15
```

```r
## mean for Drug A, Drug B, and Placebo
e9subset <- subset(ex9.1, Group == 1 | Group==4, select = Mood)
mean(e9subset$Mood)
```

```
## [1] 24.5
```

```r
e10subset <- subset(ex9.1, Group ==2 | Group==5, select = Mood)
mean(e10subset$Mood)
```

```
## [1] 22.5
```

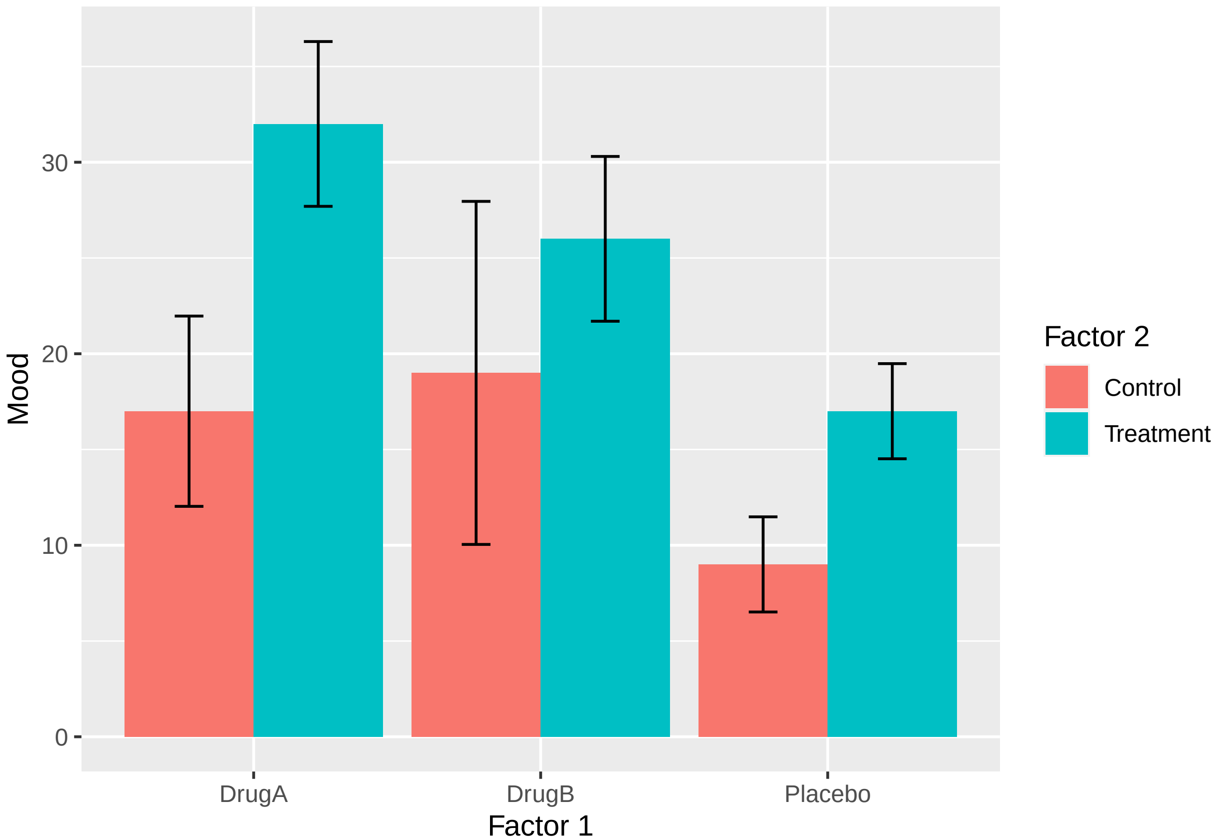
```r
e11subset <- subset(ex9.1, Group==3| Group== 6, select = Mood)
mean(e11subset$Mood)
```

```
## [1] 13
```

Figures

```r
library(ggplot2)
bar <- ggplot(ex9.1, aes(Drug, Mood, fill=Psychotherapy))
bar + stat_summary(fun.y = mean, geom = "bar", position="dodge") + stat_summary(fun.data= mean_cl_normal
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

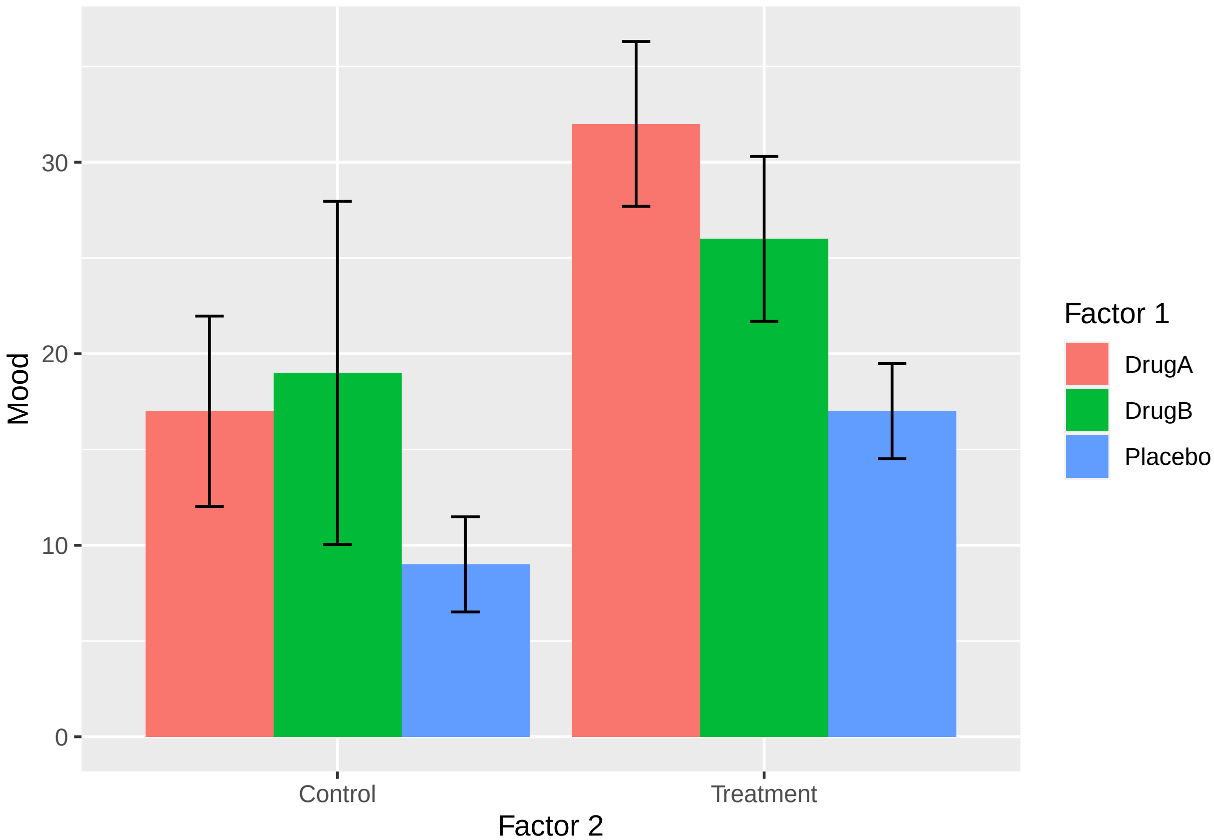



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R files/Chpt 9/Chpt9 Factorial Anova.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
bar2 <- ggplot(ex9.1, aes(Psychotherapy, Mood, fill=Drug))
bar2 + stat_summary(fun.y = mean, geom = "bar", position="dodge") + stat_summary(fun.data= mean_cl_norma
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

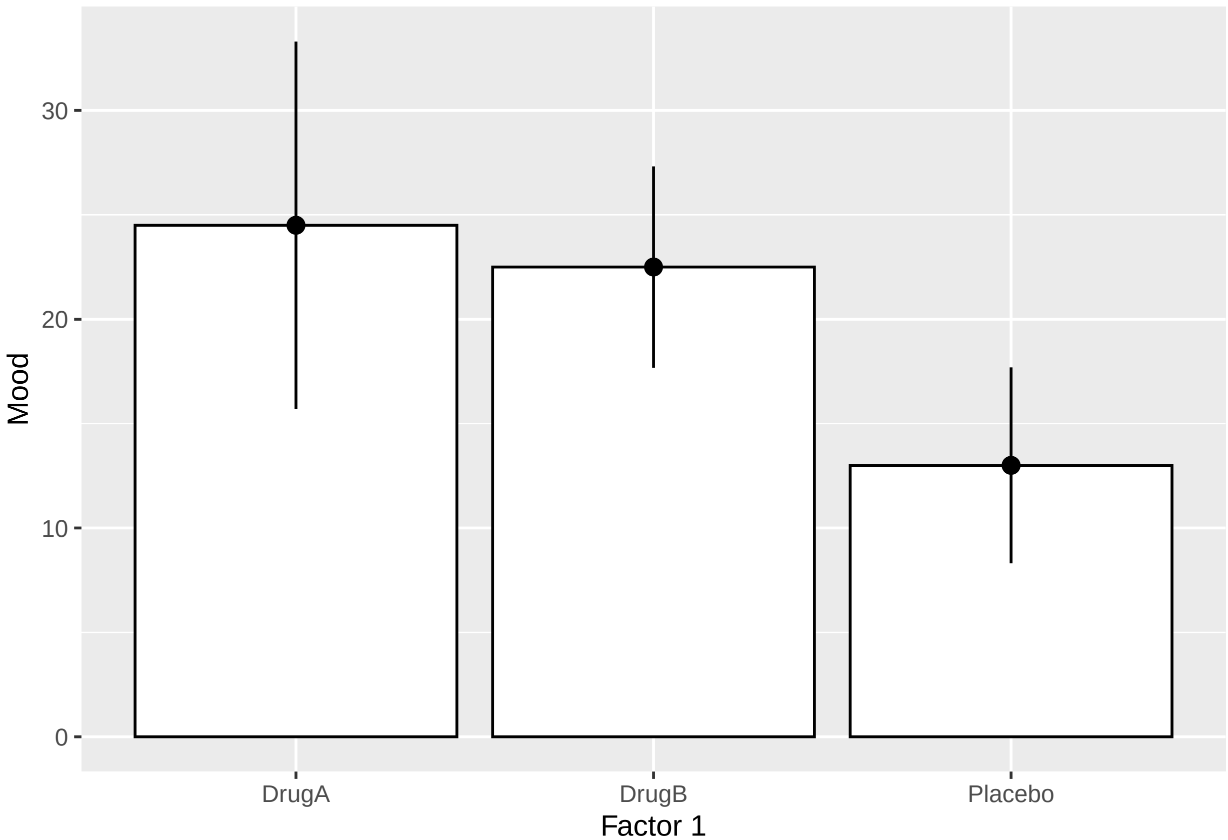



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 Factorial Anova2.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
barDrug <-ggplot(ex9.1, aes(Drug, Mood))
barDrug + stat_summary(fun.y=mean, geom = "bar", fill="White", color = "Black") + stat_summary(fun.data
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

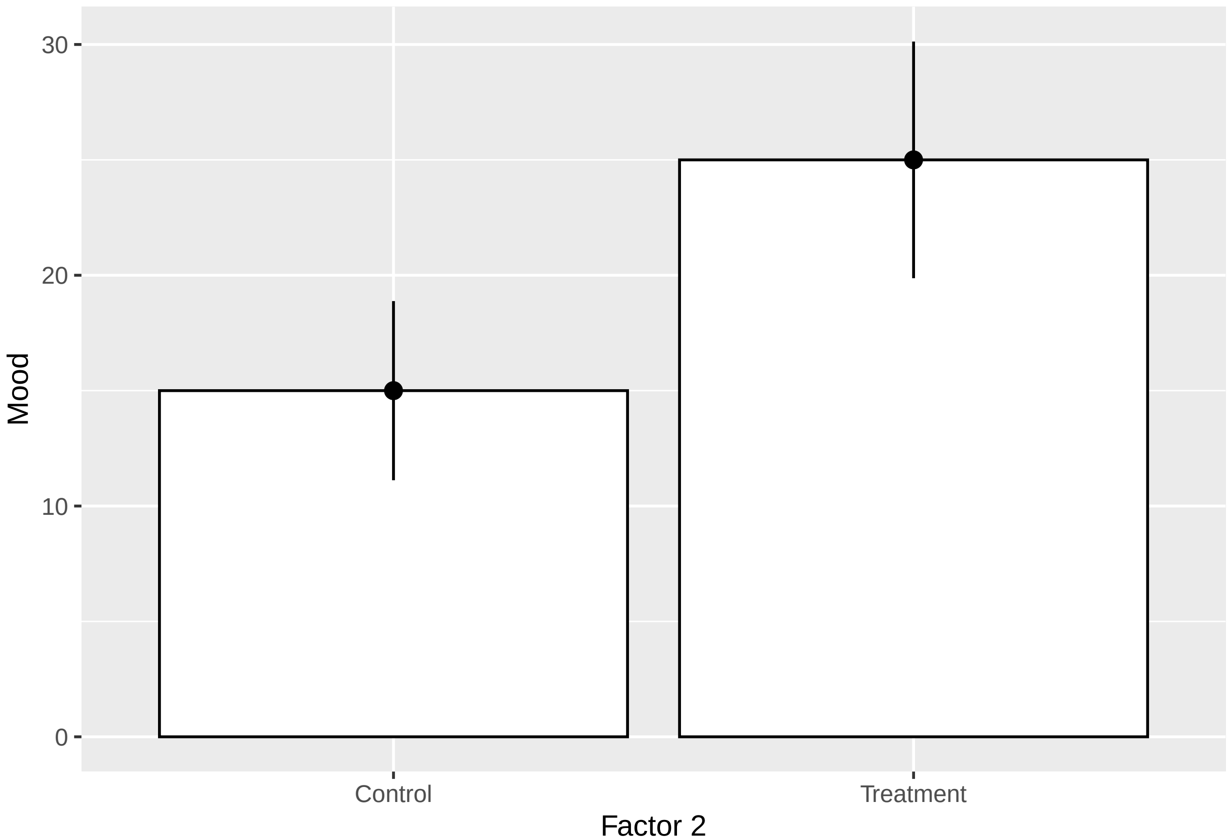



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 Drug ME.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
barTherapy <-ggplot(ex9.1, aes(Psychotherapy, Mood))
barTherapy + stat_summary(fun.y=mean, geom = "bar", fill="White", color = "Black") + stat_summary(fun.da
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```




```r
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 Therapy ME.png")
```

```
## Saving 6.5 x 4.5 in image
```

```r
##line <- ggplot(ex9.1, aes(Drug, Mood, color=Psychotherapy))
##line + stat_summary(fun.y = mean, geom = "point") +stat_summary(fun.y = mean, geom = "line", aes(grou
```

Second example for class

```r
fugazi <- read.delim("~/Dropbox/PSYCH 8710 GLM I/Datasets/Field text/fugazi.dat")
fugazi$X1 <-c (rep(1,45),rep(-1,45))
fugazi$X2 <-c (rep(-1,15),rep(2,15),rep(-1,30),rep(2,15),rep(-1,15))
fugazi$X3 <-c (rep(1,15),rep(0,15),rep(-1,15),rep(1,15),rep(0,15),rep(-1,15))
fugazi$X4 <-c (rep(-1,15),rep(2,15),rep(-1,15),rep(1,15), rep(-2,15),rep(1,15))
fugazi$X5 <-c (rep(1,15),rep(0,15),rep(-1,15),rep(-1,15),rep(0,15),rep(1,15))

## recoding into catagorical variables
fugazi$age <- ifelse(fugazi$age==1, "Younger", ifelse(fugazi$age==2, "Older", NA))
fugazi$music <- ifelse(fugazi$music==1, "Country", ifelse(fugazi$music==2, "Pop", ifelse(fugazi$music==
```

Testing the factorial model

```r
ModelA <- lm(liking~ X1+X2+X3+X4+X5, data = fugazi)
summary(ModelA)
```

```
##
## Call:
## lm(formula = liking ~ X1 + X2 + X3 + X4 + X5, data = fugazi)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -47.267 -11.983   0.867  14.817  47.733
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  19.53333    2.07509   9.413 8.74e-15 ***
## X1           -0.08889    2.07509  -0.043    0.966
## X2           21.25000    1.46731  14.482  < 2e-16 ***
## X3           -3.11667    2.54146  -1.226    0.224
## X4           -1.00556    1.46731  -0.685    0.495
## X5          -71.95000    2.54146 -28.310  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 19.69 on 84 degrees of freedom
## Multiple R-squared:  0.9234, Adjusted R-squared:  0.9189
## F-statistic: 202.6 on 5 and 84 DF,  p-value: < 2.2e-16
```

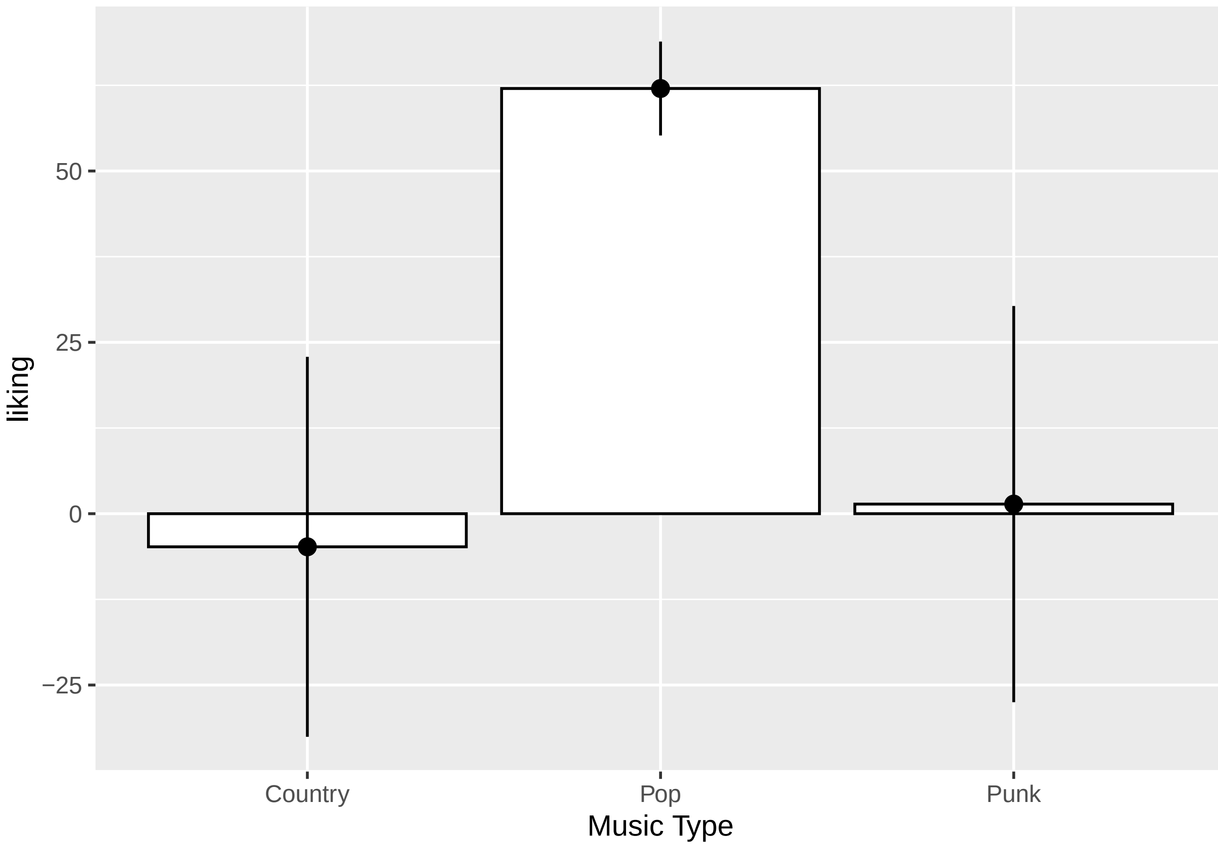
Group variables

```r
##constuct Group variable
fugazi$Group <- c(rep(1,15),rep(2,15),rep(3,15),rep(4,15),rep(5,15),rep(6,15))
```

Making figures

```r
library(ggplot2)
barMusic <-ggplot(fugazi, aes(music, liking))
barMusic + stat_summary(fun.y=mean, geom = "bar", fill="White", color = "Black") + stat_summary(fun.data
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

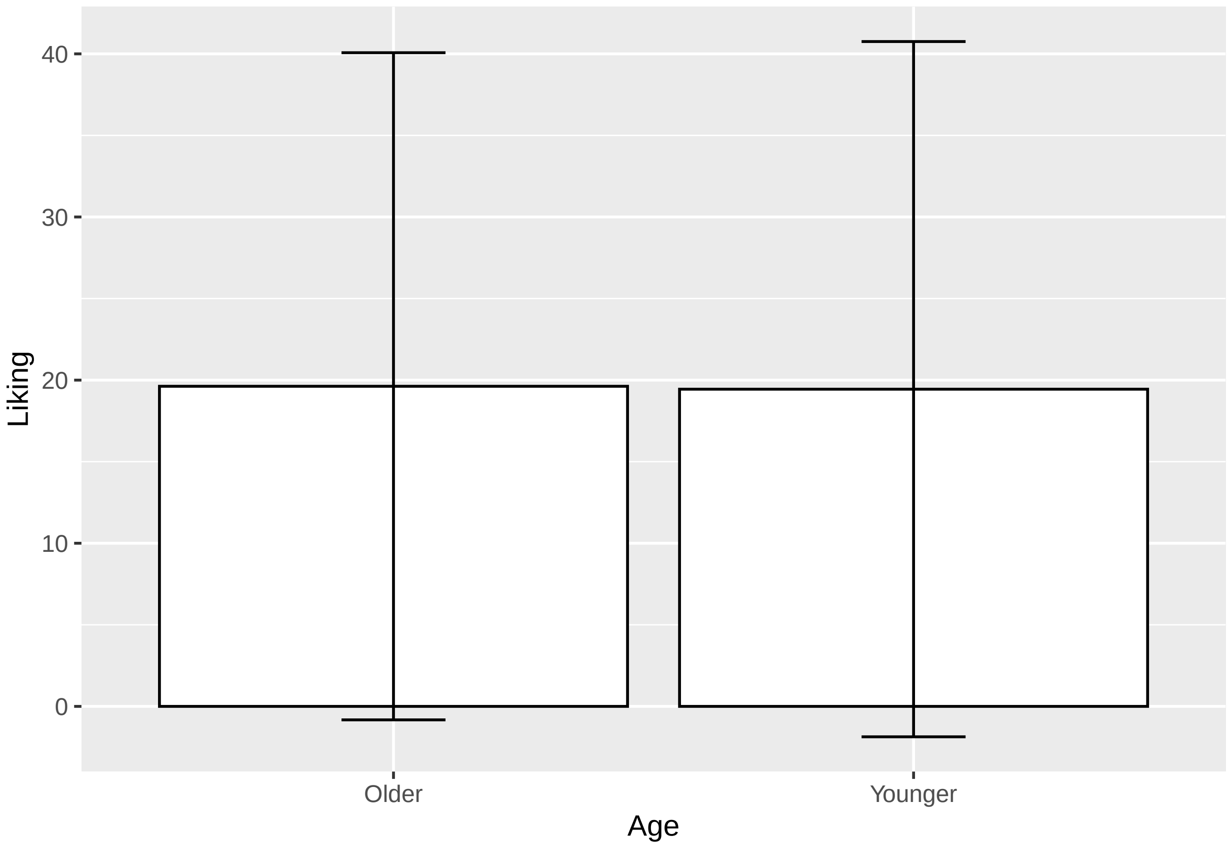



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 Music ME.png")

## Saving 6.5 x 4.5 in image

barAge <- ggplot(fugazi, aes(age, liking))
barAge + stat_summary(fun.y = mean, geom = "bar", position = "dodge", fill="White", color="Black") +sta

## Warning: `fun.y` is deprecated. Use `fun` instead.
```



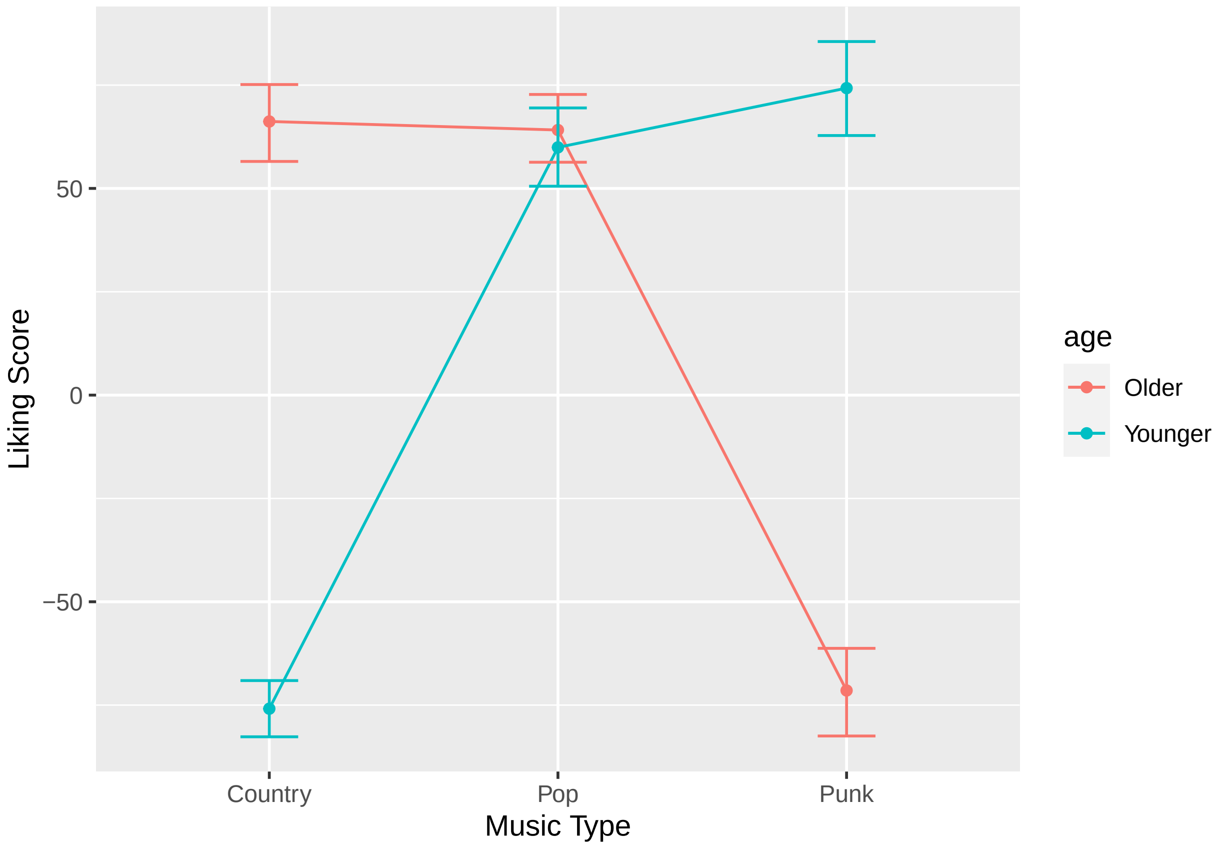

```r
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 Age ME.png")
```

```
## Saving 6.5 x 4.5 in image
```

```r
line <-ggplot(fugazi, aes(music,liking, color=age))
line + stat_summary(fun.y = mean, geom = "point") + stat_summary(fun.y = mean,geom = "line", aes(group=a
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```



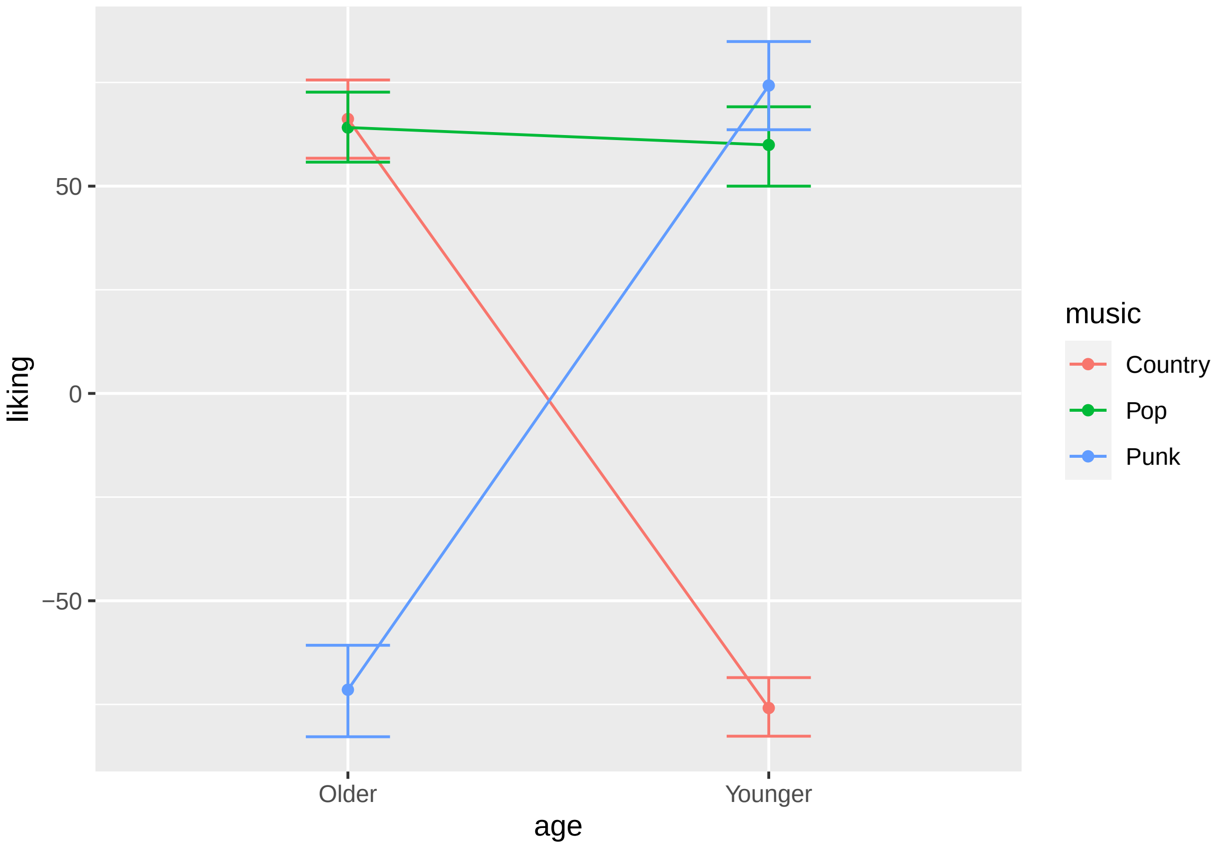

```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 MusicXAge.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
line2 <- ggplot(fugazi, aes(age,liking, color=music))
line2 + stat_summary(fun.y = mean, geom = "point") + stat_summary(fun.y = mean, geom = "line", aes(grou
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.

## Warning: `fun.y` is deprecated. Use `fun` instead.
```

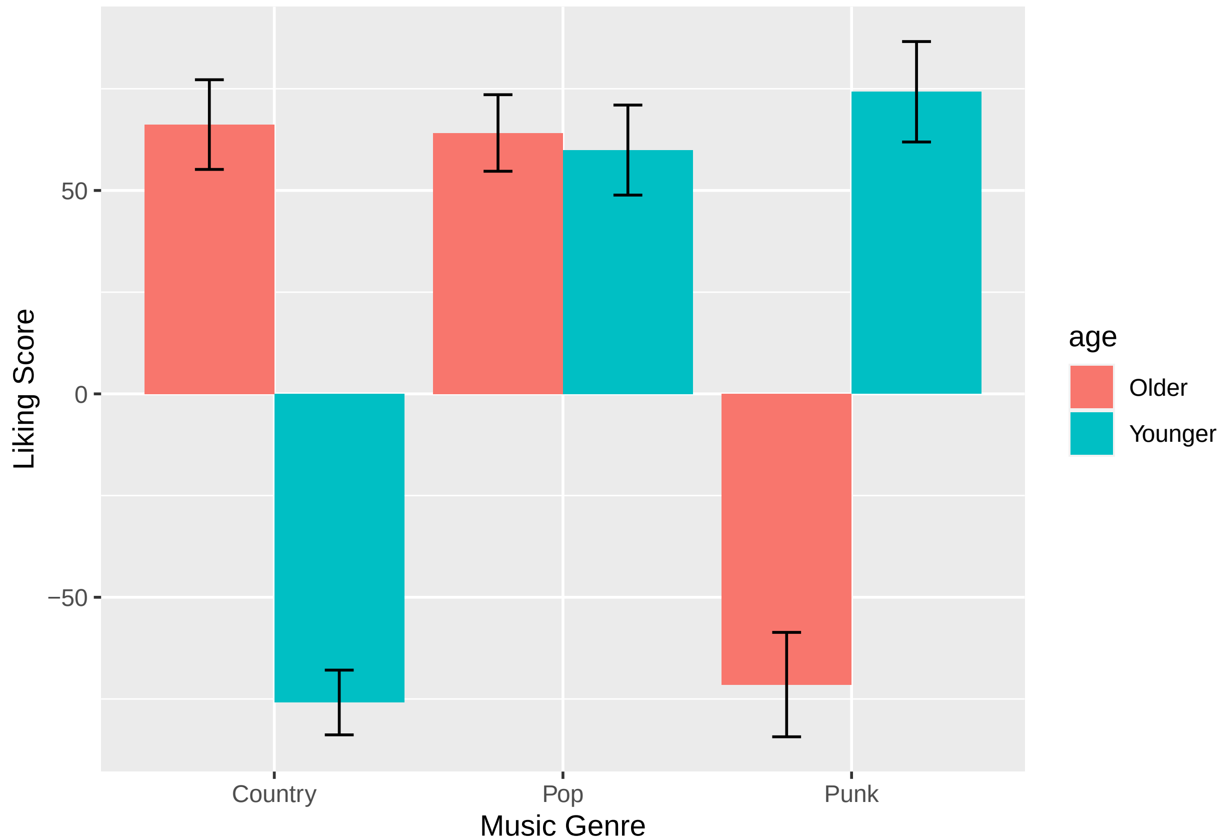



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 MusicXAge2.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
barInt <- ggplot(fugazi, aes(music,liking,fill=age))
barInt + stat_summary(fun.y = mean, geom = "bar", position = "dodge") + stat_summary(fun.data = mean_cl
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

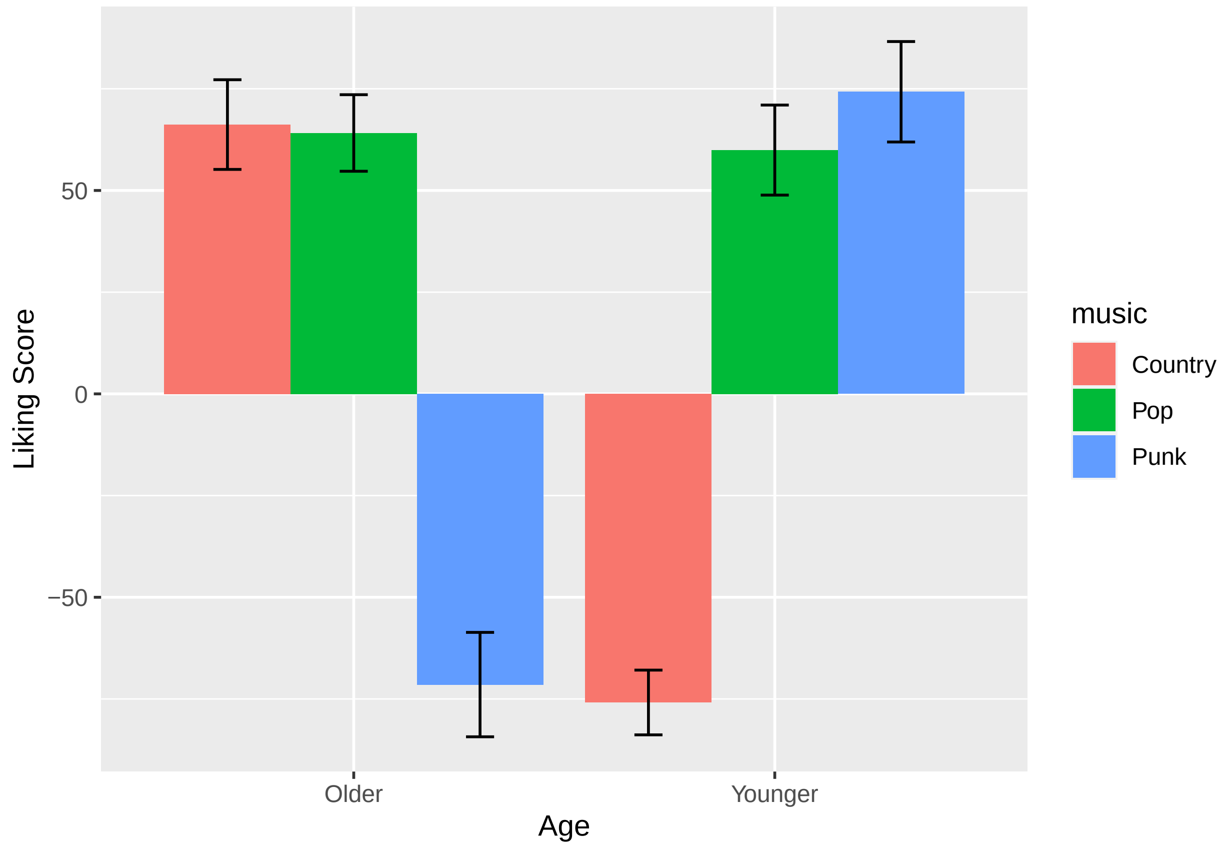



```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 MusicXAge BAR.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
barInt2 <- ggplot(fugazi, aes(age, liking, fill=music))
barInt2 + stat_summary(fun.y = mean, geom = "bar", position = "dodge") + stat_summary(fun.data = mean_cl
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```




```
ggsave("~/Dropbox/PSYCH 8710 GLM I/R Files/Chpt 9/Chpt9 MusicXAge BAR2.png")
```

```
## Saving 6.5 x 4.5 in image
```

Group Means

```
##mean for young vs. old
e1subset <- subset(fugazi, Group == 1 | Group==2| Group== 3, select = liking)
mean(e1subset$liking)
```

```
## [1] 19.44444
```

```
e2subset <- subset(fugazi, Group == 4 | Group==5| Group== 6, select = liking)
mean(e2subset$liking)
```

```
## [1] 19.62222
```

```
## mean for Group 1
e1subset <- subset(fugazi, Group == 1, select=liking)
mean(e1subset$liking)
```

```
## [1] -75.86667
```

```
## mean for Group 2
e2subset <- subset(fugazi, Group == 2, select = liking)
mean(e2subset$liking)
```

```
## [1] 59.93333
```

```r
## mean for Group 3
e3subset <- subset(fugazi, Group == 3, select = liking)
mean(e3subset$liking)
```

```
## [1] 74.26667
```

```r
## mean for Group 4
e4subset <- subset(fugazi, Group == 4, select = liking)
mean(e4subset$liking)
```

```
## [1] 66.2
```

```r
## mean for Group 5
e5subset <- subset(fugazi, Group == 5, select = liking)
mean(e5subset$liking)
```

```
## [1] 64.13333
```

```r
## mean for Group 6
e6subset <- subset(fugazi, Group == 6, select = liking)
mean(e6subset$liking)
```

```
## [1] -71.46667
```

```r
## mean for Music Genre
Countrysubset <- subset(fugazi, Group == 1 | Group==4, select = liking)
mean(Countrysubset$liking)
```

```
## [1] -4.833333
```

```r
PopSubset <- subset(fugazi, Group ==2 | Group==5, select = liking)
mean(PopSubset$liking)
```

```
## [1] 62.03333
```

```r
PunkSubset <- subset(fugazi, Group==3| Group== 6, select = liking)
mean(PunkSubset$liking)
```

```
## [1] 1.4
```