Lab 5

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1

```
options(contrasts = c('contr.helmert', 'contr.poly'))

training <- factor(c(rep(1,8),rep(2,8)))
stress <- factor(c(1,1,2,2,3,3,4,4,1,1,2,2,3,3,4,4))
exp <- c(2,9,2,19,7,0,10,12,4,2,2,3,4,2,2,0)
err <- c(3,5,4,6,5,9,4,6,4,4,5,3,5,5,10,10)

dat <- data.frame(training,stress,exp,err)

mod.1 <- lm(err~training + stress + training:stress, dat)
Anova(mod.1, type = 3)
```

```
## Anova Table (Type III tests)
##
## Response: err
##                 Sum Sq Df  F value    Pr(>F)
## (Intercept)        484  1 242.0000 2.905e-07 ***
## training             1  1   0.5000   0.49958
## stress              30  3   5.0000   0.03058 *
## training:stress     29  3   4.8333   0.03324 *
## Residuals           16  8
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

1b

```
mod.2 <- lm(err~training + stress, dat)
mod.3 <- lm(err~training + stress + training:stress, dat)

anova(mod.2,mod.3)
```

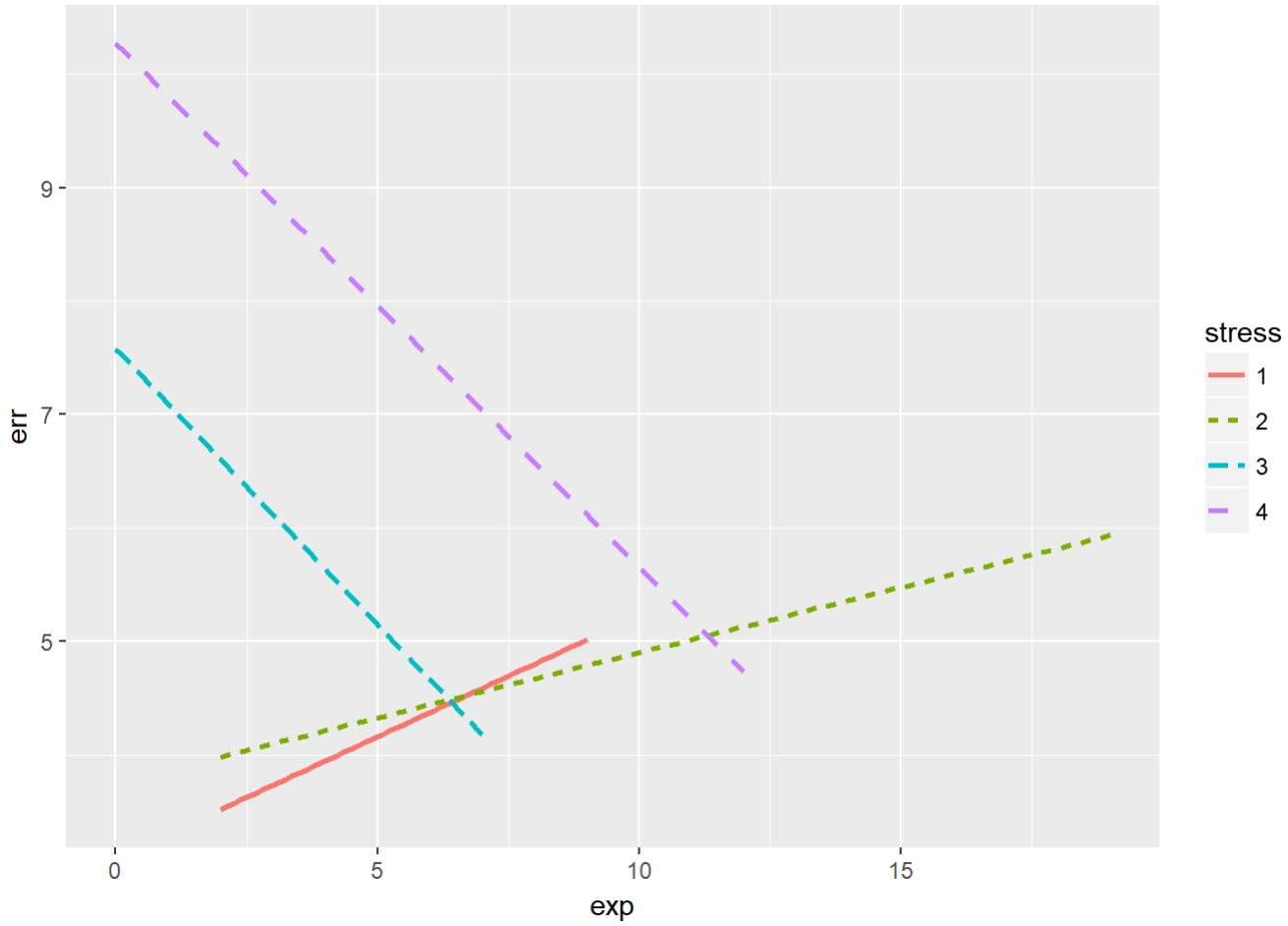
```
## Analysis of Variance Table
##
## Model 1: err ~ training + stress
## Model 2: err ~ training + stress + training:stress
##   Res.Df RSS Df Sum of Sq      F  Pr(>F)
## 1     11  45
## 2      8  16  3        29 4.8333 0.03324 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

2

```
mod.4 <- lm(err~stress + exp + stress:exp, dat)
summary(mod.4)
```

```
##
## Call:
## lm(formula = err ~ stress + exp + stress:exp, data = dat)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.65385 -0.54819  0.03509  0.69599  1.42056
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  6.17347    0.50868  12.136 1.97e-06 ***
## stress1      0.33099    0.72120   0.459   0.6585
## stress2      1.38561    0.42036   3.296   0.0109 *
## stress3      1.36526    0.28933   4.719   0.0015 **
## exp         -0.15474    0.09240  -1.675   0.1325
## stress1:exp -0.04945    0.12105  -0.409   0.6936
## stress2:exp -0.21676    0.09231  -2.348   0.0468 *
## stress3:exp -0.10227    0.04284  -2.387   0.0440 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.288 on 8 degrees of freedom
## Multiple R-squared:  0.8253, Adjusted R-squared:  0.6725
## F-statistic: 5.399 on 7 and 8 DF,  p-value: 0.01503
```

```
ggplot(dat, aes(x = exp, err, color = stress)) +
  geom_smooth(aes(linetype = stress), method = 'lm', se = F)
```



I think plain english would be, there is an interaction, specifically that errors increase as stress goes up for conditions 1 and 2. Errors go down for stress levels 3 and 4.

3

```
dat <- dat %>% mutate(stress.num = as.numeric(stress))
```

```
## Warning: package 'bindrcpp' was built under R version 3.3.3
```

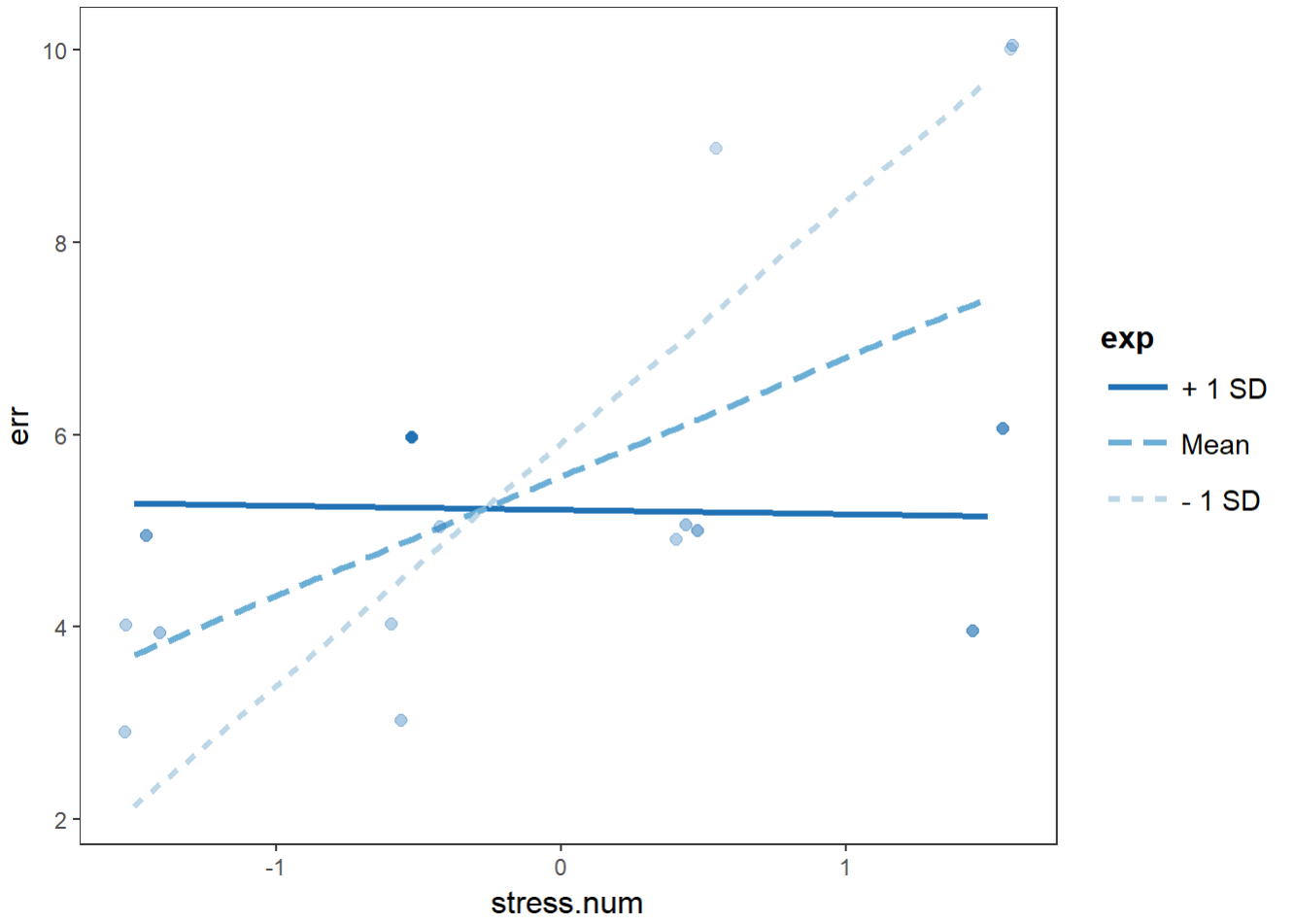
```
mod.5 <- lm(err~stress.num*exp,dat)
summ(mod.5,center = TRUE)
```

```
## MODEL INFO:
## Observations: 16
## Dependent Variable: err
##
## MODEL FIT:
## F(3,12) = 10.49, p = 0
## R-squared = 0.72
## Adj. R-squared = 0.65
##
## Standard errors: OLS
##                 Est. S.E. t val.    p
## (Intercept)     5.56 0.33  16.8  0    ***
## stress.num      1.24 0.3    4.18 0     **
## exp            -0.07 0.07  -1.02 0.33
## stress.num:exp -0.25 0.07  -3.68 0     **
##
## All continuous predictors are mean-centered.
```

```
sim_slopes(mod.5, pred = stress.num, modx = exp, johnson_neyman = FALSE, cond.int = TRUE, center
ed = c('stress.num', 'exp'))
```

```
## SIMPLE SLOPES ANALYSIS
##
## Slope of stress.num when exp = 5.16 (+ 1 SD):
##  Est.  S.E.     p
## -0.04  0.45  0.92
## Conditional intercept when exp = 5.16 (+ 1 SD):
## Est. S.E.    p
## 5.21 0.48 0.00
##
## Slope of stress.num when exp = 0 (Mean):
## Est. S.E.    p
## 1.24 0.30 0.00
## Conditional intercept when exp = 0 (Mean):
## Est. S.E.    p
## 5.56 0.33 0.00
##
## Slope of stress.num when exp = -5.16 (- 1 SD):
## Est. S.E.    p
## 2.52 0.46 0.00
## Conditional intercept when exp = -5.16 (- 1 SD):
## Est. S.E.    p
## 5.91 0.48 0.00
```

```
interact_plot(mod.5, stress.num, modx = exp, centered = c('stress.num', 'exp'), plot.points = TR
UE)
```



Essentially, experience has a negative slope with errors made.

3a

```
mod.6 <- lm(err~stress.num + exp + stress.num:exp,dat)
summary(mod.6, type = 3)
```

```
##
## Call:
## lm(formula = err ~ stress.num + exp + stress.num:exp, data = dat)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.8295 -0.9033  0.2190  0.7531  1.8605
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)     -0.3012     1.2173  -0.247 0.808760
## stress.num       2.4802     0.4535   5.469 0.000143 ***
## exp              0.5535     0.1844   3.002 0.011019 *
## stress.num:exp  -0.2484     0.0675  -3.680 0.003150 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.322 on 12 degrees of freedom
## Multiple R-squared:  0.7239, Adjusted R-squared:  0.6548
## F-statistic: 10.49 on 3 and 12 DF,  p-value: 0.001136
```

Interaction is significant, so we are not justified in using ANCOVA.

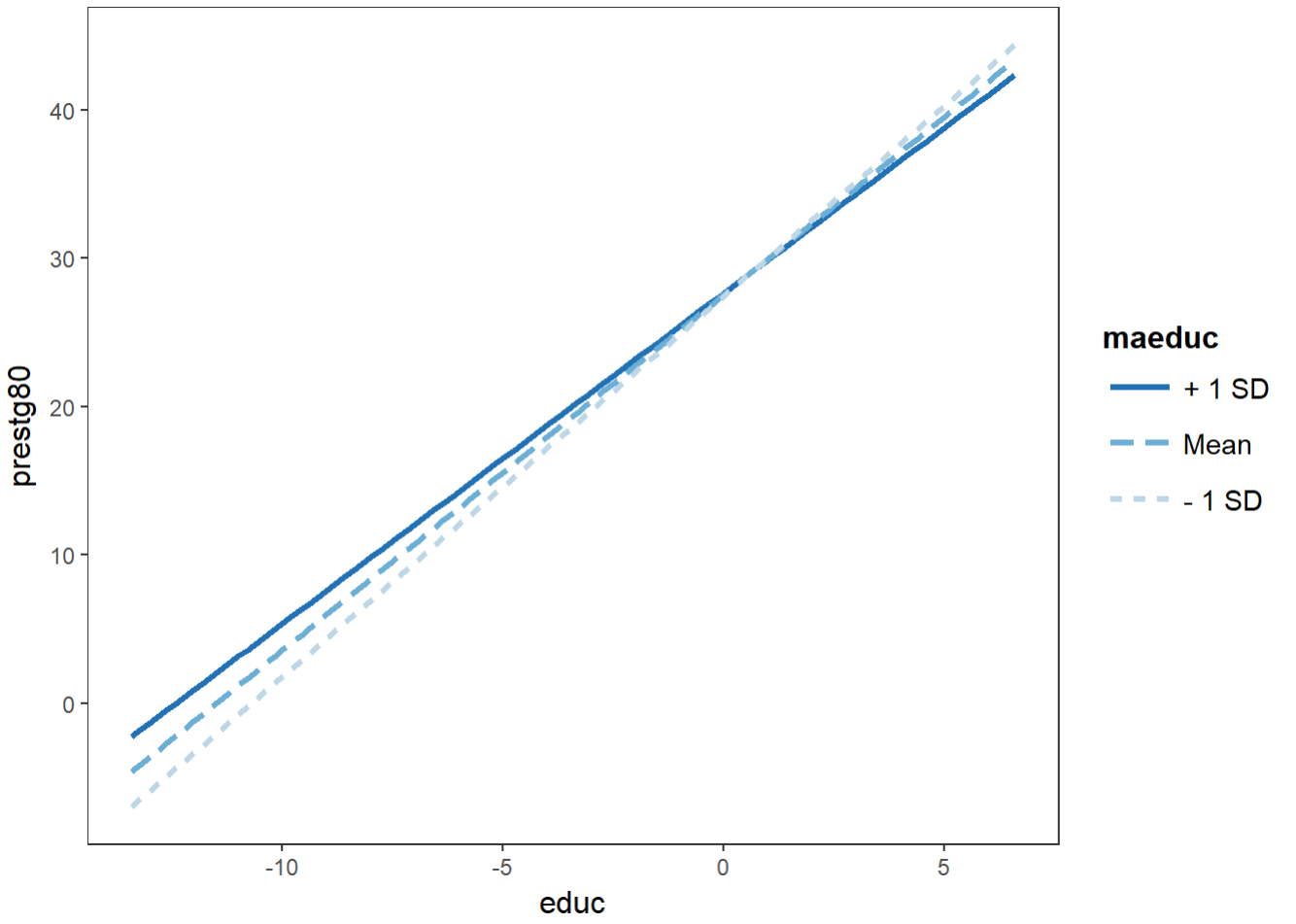
4

```
load("C:/Users/Branly Mclanbry/Downloads/lab5.RData")

mod.6 <- lm(prestg80~educ + maeduc + educ*maeduc,lab5)
summ(mod.6,center = TRUE)
```

```
## MODEL INFO:
## Observations: 1162
## Dependent Variable: prestg80
##
## MODEL FIT:
## F(3,1158) = 133.3, p = 0
## R-squared = 0.26
## Adj. R-squared = 0.25
##
## Standard errors: OLS
##              Est. S.E. t val.    p
## (Intercept) 27.53 0.34  81.53 0    ***
## educ         2.4  0.12  19.78 0    ***
## maeduc       0.02 0.06   0.3  0.77
## educ:maeduc -0.03 0.02  -1.41 0.16
##
## All continuous predictors are mean-centered.
```

```
interact_plot(mod.6, pred = educ, modx = maeduc, centered = c('educ', 'maeduc'))
```


40
30
20
10
0
prestg80
-10
-5
0
5
educ
maeduc
+ 1 SD
Mean
- 1 SD