MAS-moodchanges

```
library(knitr)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(broom)
library(ggplot2)
library(readr)
library(lme4)
```

```
## Loading required package: Matrix
```

adjust data: create variables for variance and SE of mood.x, and variance and SE of mood.y

```
moods2 <- read_csv("/Users/kai/Library/Mobile Documents/com~apple~CloudDocs/university/Courses semester 3/multi a
gent systems/group_works/moodchanges.new environment, social, speed-table.csv", show_col_types = FALSE)
head(moods2)
```

X.run.number <dbl>
8
2
5
3
7
5

6 rows | 1-1 of 10 columns

```
# Assuming moods2 is your existing dataset
moods2 <- moods2 %>%
  group_by(X.run.number, social_influence, positive, negative, speedboost) %>%
  summarise(
    variance_mood_x = var(mood_x_of_turtle, na.rm = TRUE),
    variance_mood_y = var(mood_y_of_turtle, na.rm = TRUE)
  ) %>%
  mutate(
    se_var_mood_x = sqrt(variance_mood_x) / sqrt(n()),
    se_var_mood_y = sqrt(variance_mood_y) / sqrt(n())
  )
```

```
## `summarise()` has grouped output by 'X.run.number', 'social_influence',
## 'positive', 'negative'. You can override using the `.groups` argument.
```

```
head(moods2)
```

X.run.number <dbl>
1

	2
	3
	4
	5
	6

6 rows | 1-1 of 9 columns

POLYNOMIAL MODELS

```
social.influence = moods2$social_influence
new_dataset = moods2

# for mood.x:

# social influence
mod.lin.1xs <- lm(variance_mood_x ~ social.influence,data=new_dataset)
summary(mod.lin.1xs)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ social.influence, data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.772 -6.773 -3.056  6.604 18.793
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        5.9358     0.7865   7.547 7.88e-14 ***
## social.influence   1.4230     0.5060   2.812  0.00498 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.838 on 1438 degrees of freedom
## Multiple R-squared:  0.005471,   Adjusted R-squared:  0.004779
## F-statistic:  7.91 on 1 and 1438 DF,  p-value: 0.004983
```

```
mod.quad.1xs <- lm(variance_mood_x ~ social.influence + I(social.influence^2),data=new_dataset)
summary(mod.quad.1xs)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ social.influence + I(social.influence^2),
##     data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.764 -6.774 -3.052  6.612 18.777
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            5.73130    3.73650   1.534    0.125
## social.influence       1.71752    5.28421   0.325    0.745
## I(social.influence^2) -0.09817    1.75331  -0.056    0.955
##
## Residual standard error: 7.841 on 1437 degrees of freedom
## Multiple R-squared:  0.005473,   Adjusted R-squared:  0.004089
## F-statistic: 3.954 on 2 and 1437 DF,  p-value: 0.01939
```

```
mod.cub.1xs <- lm(variance_mood_x ~ social.influence + I(social.influence^2) + I(social.influence^3),data=new_dat
aset)
summary(mod.cub.1xs)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ social.influence + I(social.influence^2) +
##     I(social.influence^3), data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.764 -6.774 -3.052  6.612 18.777
##
## Coefficients: (1 not defined because of singularities)
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            5.73130    3.73650   1.534    0.125
## social.influence       1.71752    5.28421   0.325    0.745
## I(social.influence^2) -0.09817    1.75331  -0.056    0.955
## I(social.influence^3)       NA         NA      NA       NA
##
## Residual standard error: 7.841 on 1437 degrees of freedom
## Multiple R-squared:  0.005473,   Adjusted R-squared:  0.004089
## F-statistic: 3.954 on 2 and 1437 DF,  p-value: 0.01939
```

```
#positive
mod.lin.1xp <- lm(variance_mood_x ~ positive,data=new_dataset)
summary(mod.lin.1xp)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ positive, data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.581 -6.290 -3.355  6.476 19.002
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.5501     0.3430  19.099  < 2e-16 ***
## positive      5.0673     0.9166   5.528 3.83e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.778 on 1438 degrees of freedom
## Multiple R-squared:  0.02081,    Adjusted R-squared:  0.02013
## F-statistic: 30.56 on 1 and 1438 DF,  p-value: 3.833e-08
```

```
mod.quad.1xp <- lm(variance_mood_x ~ positive + I(positive^2),data=new_dataset)
summary(mod.quad.1xp)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ positive + I(positive^2), data = new_dataset)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.186  -5.350  -2.215   5.574  21.441
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     3.9303     0.3763   10.45   <2e-16 ***
## positive       44.3646     3.0214   14.68   <2e-16 ***
## I(positive^2) -65.4954     4.8258  -13.57   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.325 on 1437 degrees of freedom
## Multiple R-squared:  0.1321, Adjusted R-squared:  0.1309
## F-statistic: 109.3 on 2 and 1437 DF,  p-value: < 2.2e-16
```

```
mod.cub.1xp <- lm(variance_mood_x ~ positive + I(positive^2) + I(positive^3),data=new_dataset)
summary(mod.cub.1xp)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ positive + I(positive^2) + I(positive^3),
##     data = new_dataset)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.479  -5.595  -1.992   5.310  21.932
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.4392     0.3818   9.007  < 2e-16 ***
## positive        82.8371     7.3252  11.309  < 2e-16 ***
## I(positive^2) -249.6726    32.3705  -7.713 2.28e-14 ***
## I(positive^3)  204.6413    35.5741   5.753 1.07e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.245 on 1436 degrees of freedom
## Multiple R-squared:  0.1516, Adjusted R-squared:  0.1498
## F-statistic: 85.54 on 3 and 1436 DF,  p-value: < 2.2e-16
```

```
#negative
mod.lin.1xn <- lm(variance_mood_x ~ negative,data=new_dataset)
summary(mod.lin.1xn)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ negative, data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.696 -6.640 -2.953  6.655 17.822
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.0350     0.4330  13.937  < 2e-16 ***
## negative     -3.7006     0.6934  -5.337  1.1e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.783 on 1438 degrees of freedom
## Multiple R-squared:  0.01942,    Adjusted R-squared:  0.01874
## F-statistic: 28.48 on 1 and 1438 DF,  p-value: 1.097e-07
```

```
mod.quad.1xn <- lm(variance_mood_x ~ negative + I(negative^2),data=new_dataset)
summary(mod.quad.1xn)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ negative + I(negative^2), data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.311 -6.766 -2.776  6.627 17.817
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     2.5893     0.9276   2.791  0.00532 **
## negative      -18.5172     3.5998  -5.144 3.06e-07 ***
## I(negative^2) -12.0601     2.8758  -4.194 2.91e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.739 on 1437 degrees of freedom
## Multiple R-squared:  0.03128,    Adjusted R-squared:  0.02993
## F-statistic:  23.2 on 2 and 1437 DF,  p-value: 1.213e-10
```

```
mod.cub.1xn <- lm(variance_mood_x ~ negative + I(negative^2) + I(negative^3),data=new_dataset)
summary(mod.cub.1xn)
```

```
##
## Call:
## lm(formula = variance_mood_x ~ negative + I(negative^2) + I(negative^3),
##     data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.355 -6.740 -2.788  6.588 17.825
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.080      2.748   1.121    0.263
## negative       -14.869     19.574  -0.760    0.448
## I(negative^2)   -4.684     39.007  -0.120    0.904
## I(negative^3)    4.226     22.287   0.190    0.850
##
## Residual standard error: 7.741 on 1436 degrees of freedom
## Multiple R-squared:  0.0313, Adjusted R-squared:  0.02928
## F-statistic: 15.47 on 3 and 1436 DF,  p-value: 6.616e-10
```

```
AIC(mod.lin.1xs, mod.quad.1xs, mod.cub.1xs) # best: linear
```

mod.lin.1xs
mod.quad.1xs
mod.cub.1xs

3 rows | 1-1 of 3 columns

```
AIC(mod.lin.1xp, mod.quad.1xp, mod.cub.1xp) # best: cubic
```

mod.lin.1xp
mod.quad.1xp
mod.cub.1xp

3 rows | 1-1 of 3 columns

```
AIC(mod.lin.1xn, mod.quad.1xn, mod.cub.1xn) # best: quadratic
```

mod.lin.1xn
mod.quad.1xn
mod.cub.1xn

3 rows | 1-1 of 3 columns

```
# for mood.y:

# social influence
mod.lin.1ys <- lm(variance_mood_y ~ social.influence,data=new_dataset)
summary(mod.lin.1ys)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ social.influence, data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.139 -7.403 -2.936  7.187 18.749
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)        6.7882     0.8182   8.297 2.43e-16 ***
## social.influence   1.1764     0.5263   2.235   0.0256 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.153 on 1438 degrees of freedom
## Multiple R-squared:  0.003463,   Adjusted R-squared:  0.00277
## F-statistic: 4.997 on 1 and 1438 DF,  p-value: 0.02555
```

```
mod.quad.1ys <- lm(variance_mood_y ~ social.influence + I(social.influence^2),data=new_dataset)
summary(mod.quad.1ys)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ social.influence + I(social.influence^2),
##     data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.134 -7.400 -2.930  7.192 18.754
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            6.65723    3.88674   1.713    0.087 .
## social.influence       1.36507    5.49668   0.248    0.804
## I(social.influence^2) -0.06288    1.82380  -0.034    0.973
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.156 on 1437 degrees of freedom
## Multiple R-squared:  0.003463,   Adjusted R-squared:  0.002076
## F-statistic: 2.497 on 2 and 1437 DF,  p-value: 0.08268
```

```
mod.cub.1ys <- lm(variance_mood_y ~ social.influence + I(social.influence^2) + I(social.influence^3),data=new_dat
aset)
summary(mod.cub.1ys)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ social.influence + I(social.influence^2) +
##     I(social.influence^3), data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.134 -7.400 -2.930  7.192 18.754
##
## Coefficients: (1 not defined because of singularities)
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            6.65723    3.88674   1.713    0.087 .
## social.influence       1.36507    5.49668   0.248    0.804
## I(social.influence^2) -0.06288    1.82380  -0.034    0.973
## I(social.influence^3)       NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.156 on 1437 degrees of freedom
## Multiple R-squared:  0.003463,   Adjusted R-squared:  0.002076
## F-statistic: 2.497 on 2 and 1437 DF,  p-value: 0.08268
```

```
#positive
mod.lin.1yp <- lm(variance_mood_y ~ positive,data=new_dataset)
summary(mod.lin.1yp)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ positive, data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.603 -7.179 -3.165  7.069 19.197
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   7.5006     0.3585  20.923  < 2e-16 ***
## positive      3.5078     0.9581   3.661  0.00026 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.13 on 1438 degrees of freedom
## Multiple R-squared:  0.009235,   Adjusted R-squared:  0.008546
## F-statistic:  13.4 on 1 and 1438 DF,  p-value: 0.0002602
```

```
mod.quad.1yp <- lm(variance_mood_y ~ positive + I(positive^2),data=new_dataset)
summary(mod.quad.1yp)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ positive + I(positive^2), data = new_dataset)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.272  -5.382  -2.619   6.167  21.573
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     5.1237     0.3995   12.83   <2e-16 ***
## positive       39.1599     3.2078   12.21   <2e-16 ***
## I(positive^2) -59.4202     5.1234  -11.60   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.777 on 1437 degrees of freedom
## Multiple R-squared:  0.09404,    Adjusted R-squared:  0.09278
## F-statistic: 74.58 on 2 and 1437 DF,  p-value: < 2.2e-16
```

```
mod.cub.1yp <- lm(variance_mood_y ~ positive + I(positive^2) + I(positive^3),data=new_dataset)
summary(mod.cub.1yp)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ positive + I(positive^2) + I(positive^3),
##     data = new_dataset)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -11.872  -5.647  -2.556   6.092  22.004
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     4.6927     0.4068  11.534  < 2e-16 ***
## positive       72.9215     7.8053   9.343  < 2e-16 ***
## I(positive^2) -221.0449    34.4924  -6.409 1.99e-10 ***
## I(positive^3)  179.5830    37.9060   4.738 2.38e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.719 on 1436 degrees of freedom
## Multiple R-squared:  0.108,  Adjusted R-squared:  0.1061
## F-statistic: 57.94 on 3 and 1436 DF,  p-value: < 2.2e-16
```

```
#negative
mod.lin.1yn <- lm(variance_mood_y ~ negative,data=new_dataset)
summary(mod.lin.1yn)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ negative, data = new_dataset)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -10.059  -7.223  -2.787   7.170  17.215
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   6.7063     0.4510  14.869  < 2e-16 ***
## negative     -3.3575     0.7222  -4.649 3.65e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.107 on 1438 degrees of freedom
## Multiple R-squared:  0.01481,    Adjusted R-squared:  0.01412
## F-statistic: 21.61 on 1 and 1438 DF,  p-value: 3.645e-06
```

```
mod.quad.1yn <- lm(variance_mood_y ~ negative + I(negative^2),data=new_dataset)
summary(mod.quad.1yn)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ negative + I(negative^2), data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.702 -7.335 -2.660  7.109 17.592
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     3.6142     0.9677   3.735 0.000195 ***
## negative      -16.6535     3.7554  -4.435 9.93e-06 ***
## I(negative^2) -10.8224     3.0002  -3.607 0.000320 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.073 on 1437 degrees of freedom
## Multiple R-squared:  0.02365,    Adjusted R-squared:  0.02229
## F-statistic:  17.4 on 2 and 1437 DF,  p-value: 3.408e-08
```

```
mod.cub.1yn <- lm(variance_mood_y ~ negative + I(negative^2) + I(negative^3),data=new_dataset)
summary(mod.cub.1yn)
```

```
##
## Call:
## lm(formula = variance_mood_y ~ negative + I(negative^2) + I(negative^3),
##     data = new_dataset)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -9.805 -7.274 -2.618  7.132 17.609
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.758      2.867   1.660   0.0972 .
## negative        -8.146     20.419  -0.399   0.6900
## I(negative^2)    6.378     40.692   0.157   0.8755
## I(negative^3)    9.854     23.250   0.424   0.6717
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.076 on 1436 degrees of freedom
## Multiple R-squared:  0.02377,    Adjusted R-squared:  0.02173
## F-statistic: 11.65 on 3 and 1436 DF,  p-value: 1.511e-07
```

```
AIC(mod.lin.1ys, mod.quad.1ys, mod.cub.1ys) # best: linear
```

mod.lin.1ys

mod.quad.1ys
mod.cub.1ys

3 rows | 1-1 of 3 columns

```
AIC(mod.lin.1yp, mod.quad.1yp, mod.cub.1yp) # best: cubic
```

mod.lin.1yp
mod.quad.1yp
mod.cub.1yp

3 rows | 1-1 of 3 columns

```
AIC(mod.lin.1yn, mod.quad.1yn, mod.cub.1yn) # best: quadratic
```

mod.lin.1yn
mod.quad.1yn
mod.cub.1yn

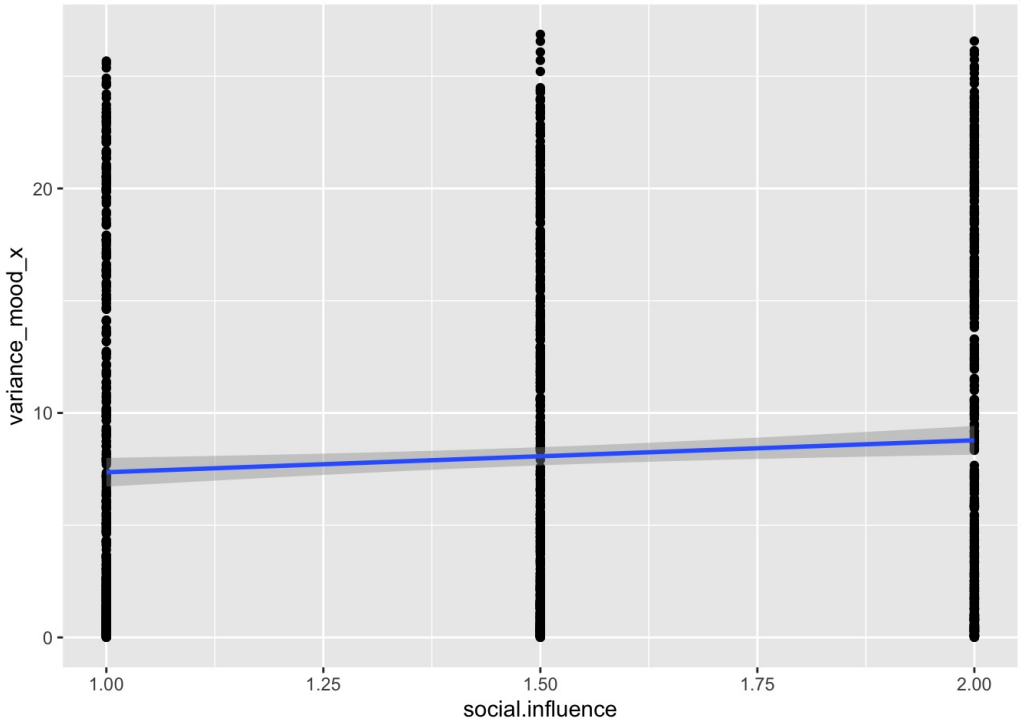
3 rows | 1-1 of 3 columns

Graphs

for mood.x:

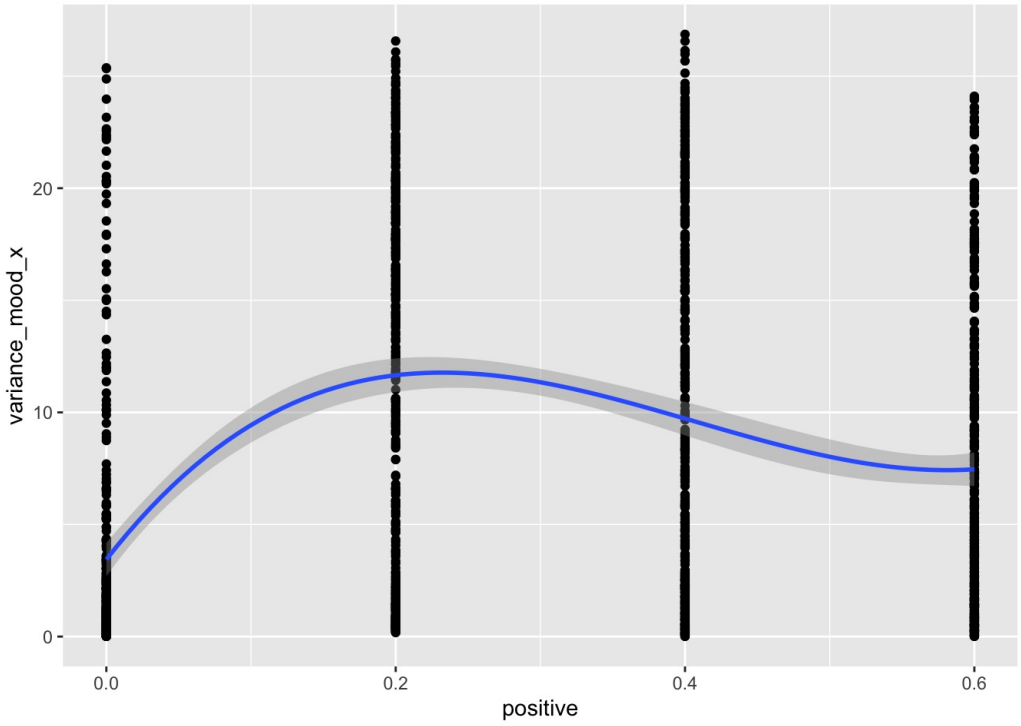
social influence

```
ggplot(new_dataset, aes(social.influence, variance_mood_x) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 1, raw = TRUE))
```



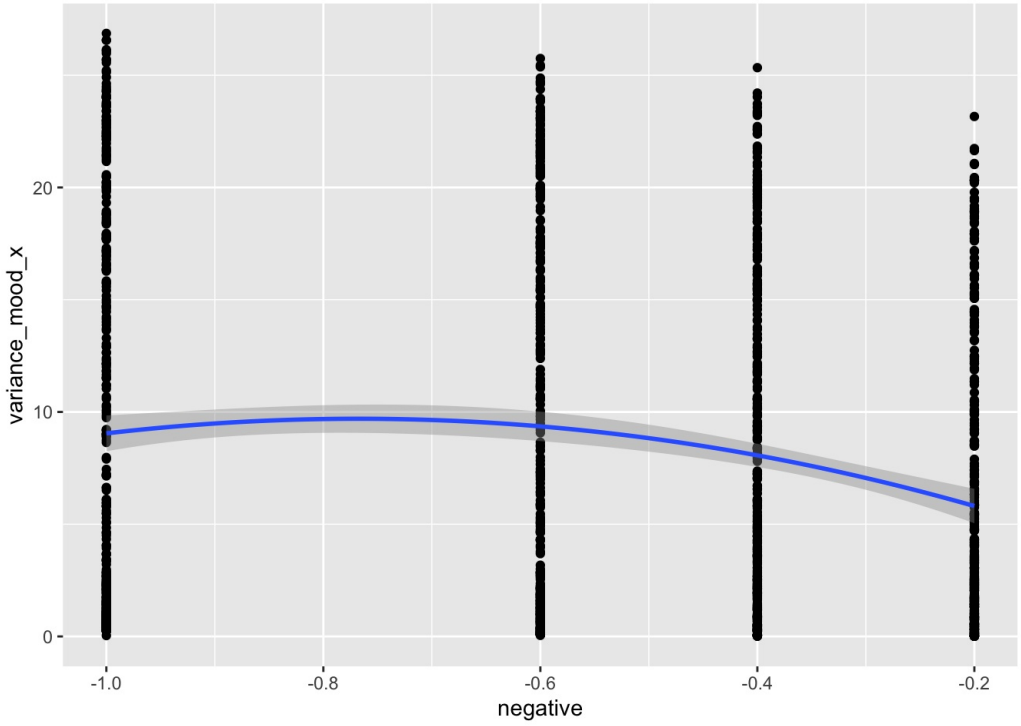
positive

```
ggplot(new_dataset, aes(positive, variance_mood_x) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 3, raw = TRUE))
```



negative

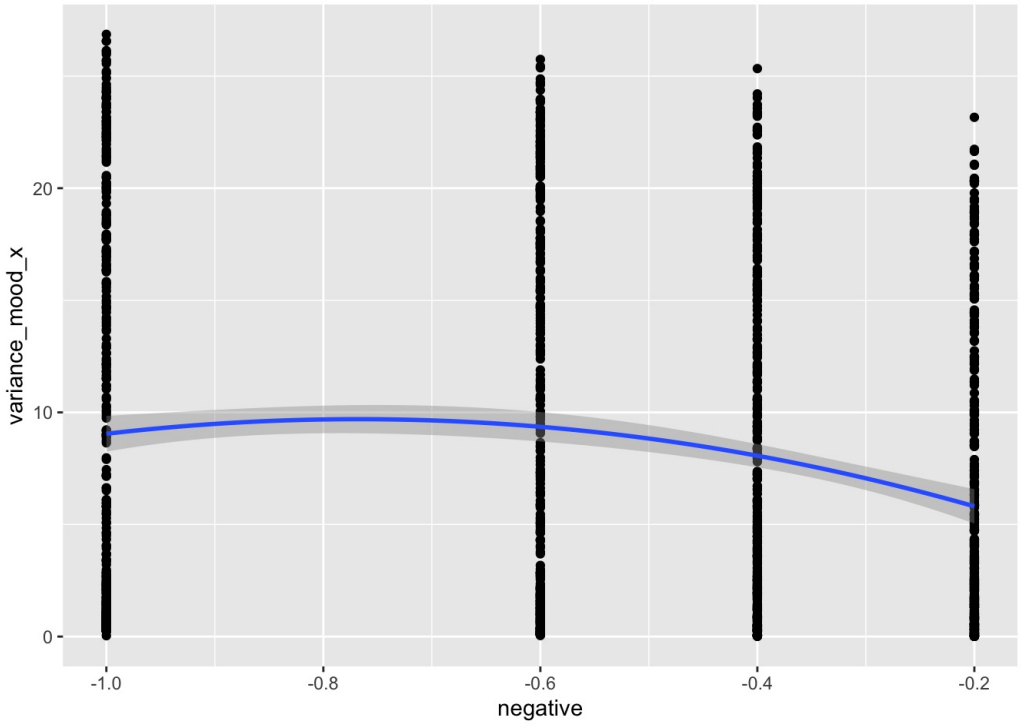
```
ggplot(new_dataset, aes(negative, variance_mood_x) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 2, raw = TRUE))
```



for mood.y:

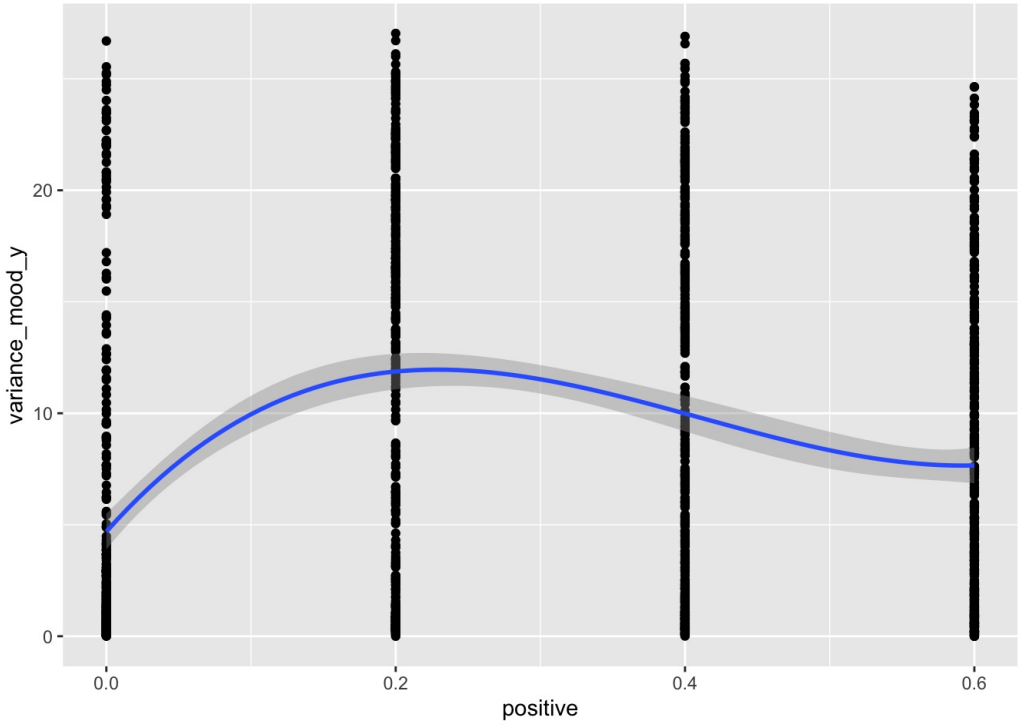
social influence

```
ggplot(new_dataset, aes(negative, variance_mood_x) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 2, raw = TRUE))
```



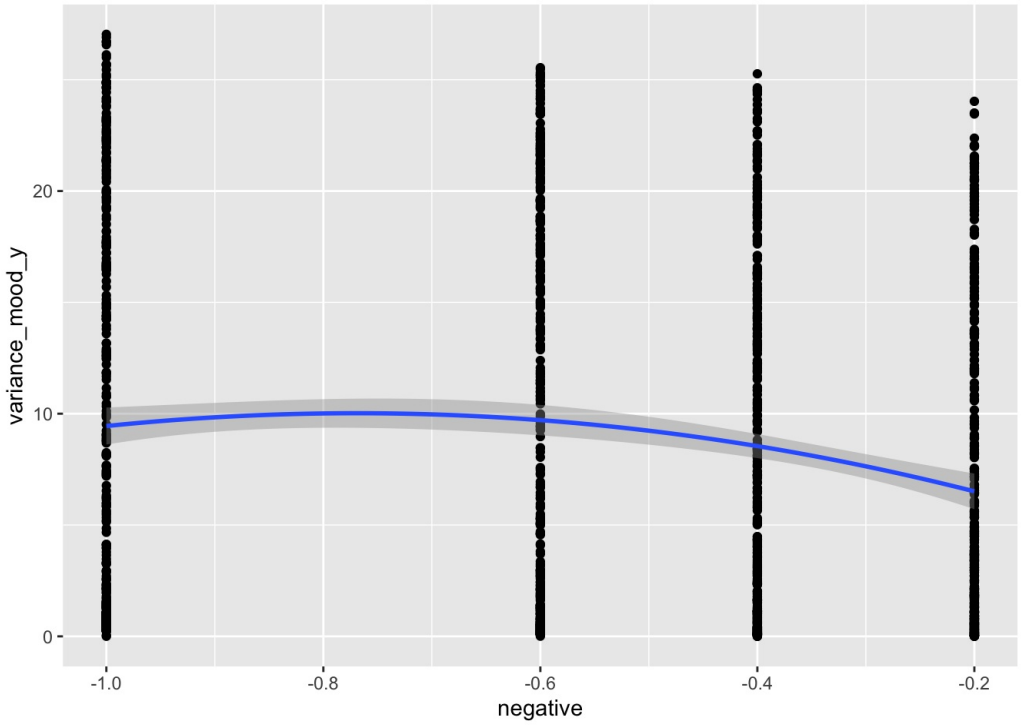
positive

```
ggplot(new_dataset, aes(positive, variance_mood_y) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 3, raw = TRUE))
```



negative

```
ggplot(new_dataset, aes(negative, variance_mood_y) ) + geom_point() +
  stat_smooth(method = lm, formula = y ~ poly(x, 2, raw = TRUE))
```


variance_mood_y
20
10
0
-1.0
-0.8
-0.6
-0.4
-0.2
negative