

Project 5: Correlation Bivariate Regression

03/17/2021

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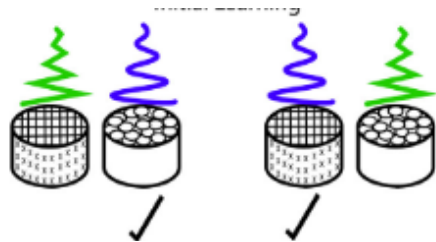
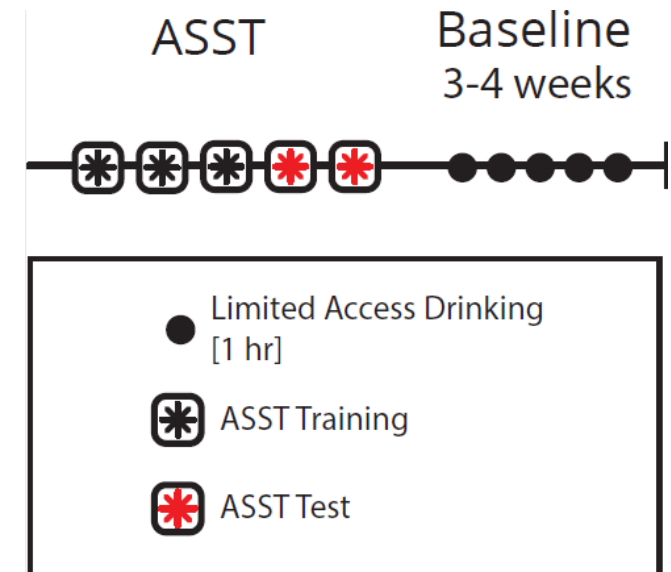
Background

- Alcohol consumption patterns vary by individuals
- Previously, in our lab we have found that chronic stress and alcohol exposure has been shown to decrease cognitive performance (Rodberg et al., 2017)
- Attentional set shifting task (ASST) measures behavioral flexibility and cognitive ability in rodents

Is there a relationship between baseline cognitive performance and future alcohol consumption?

Methods

- 16 mice (10 female, 9 male)
- Attentional set shifting
- Cognitive ability measured by performance index
- Baseline drinking (1hr, 15%)
- Drinking is calculated as grams EtOH/kg of bodyweight
 - Daily EtOH consumption averaged across last 2 weeks of baseline drinking

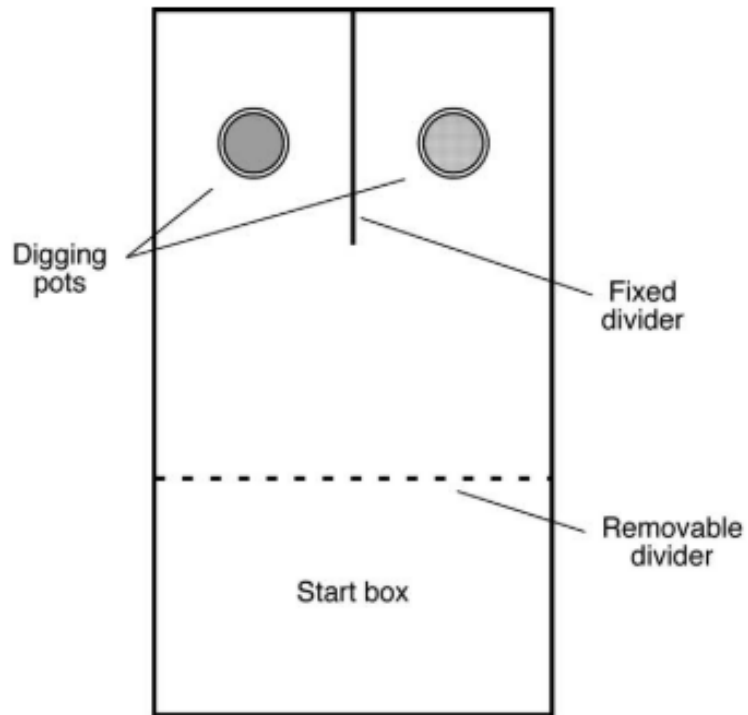


Attentional Set Shifting

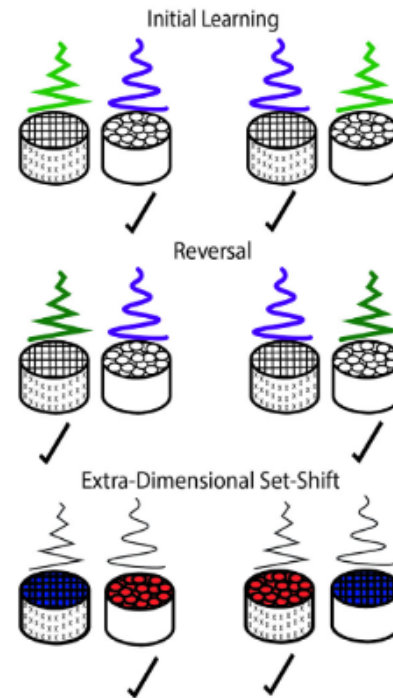


Baseline Drinking

Attentional Set Shifting Task



(Lapiz and Morilak, 2006)



(Hurtubise and Howland, 2017)

Task	Dimension	
	Relevant	Irrelevant
SD	Odor	Texture
CD	Odor	Texture
CDR	Odor	Texture
ID	Odor	Texture
IDR	Odor	Texture
ED	Texture	Odor

Combinations	
Correct	Incorrect
Cloves	Sage
Cloves and Velvet	Sage and Silk
Cloves and Silk	Sage and Velvet
Sage and Velvet	Cloves and Silk
Sage and Silk	Cloves and Velvet
Basil and Tinfoil	Cumin and Coarse Sandpaper
Basil and Coarse sandpaper	Cumin and Tinfoil
Cumin and Tinfoil	Basil and Coarse Sandpaper
Cumin and Coarse Sandpaper	Basil and Tinfoil
Burlap and Cinnamon	Fine Sandpaper and Thyme
Burlap and Thyme	Fine Sandpaper and Cinnamon

(Rodberg et al., 2017)

Variables

- X variable: Cognitive performance (performance index)

Calculate performance index for each animal:

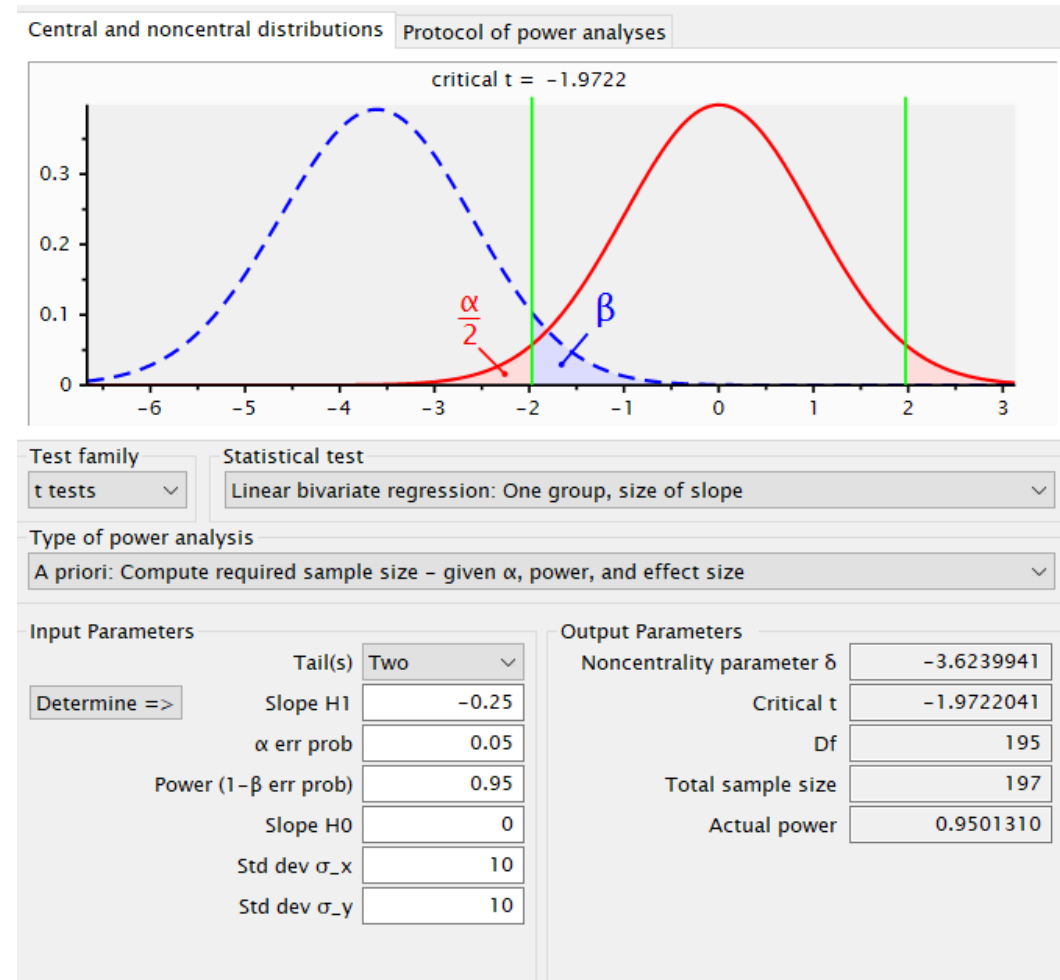
- 1) Stage reached
- 2) Average trials per stage
- 3) Average % incorrect

Higher performance index (PI) = better cognitive performance

- Y variable : Average g/kg EtOH consumed at baseline
- Nuisance variable: Sex

Apriori power analysis for bivariate regression

Assuming:
Slope H1: -0.25
Power: 0.95
Std dev of x & y: 10
Sample size: 197



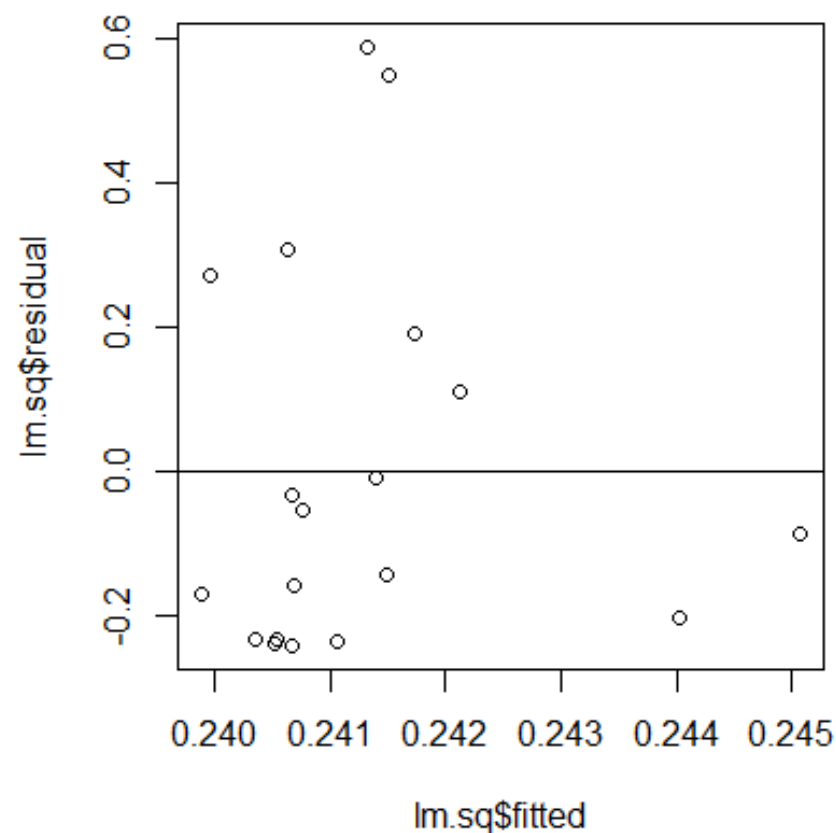
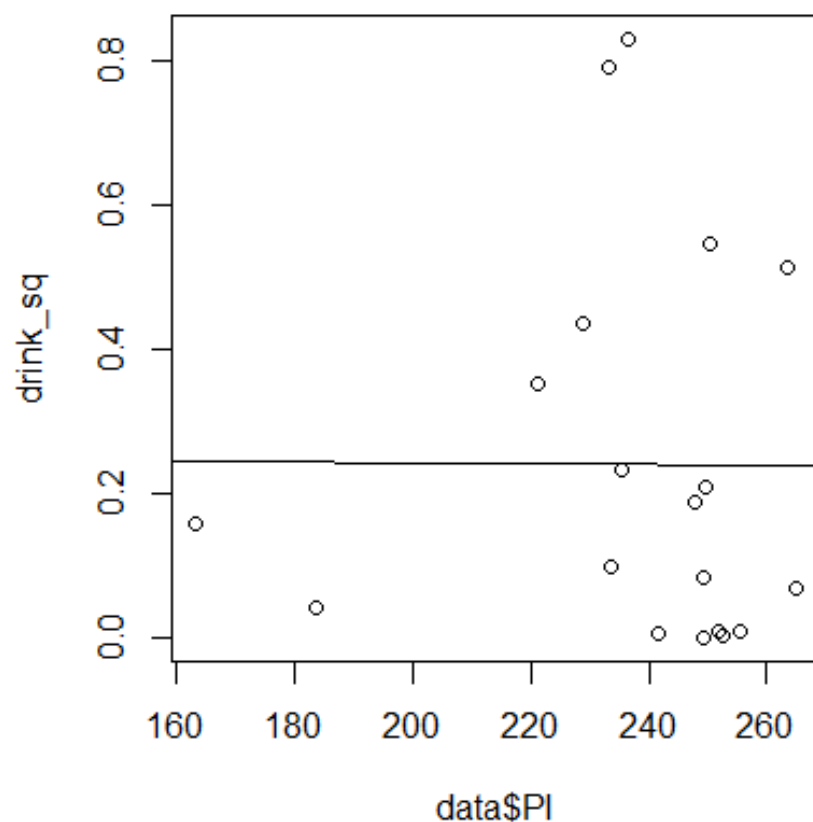
This study was underpowered

Assumptions:

Linearity: Harvey-Collier test

p-value = 0.004825

violation of linearity – we could transform the data

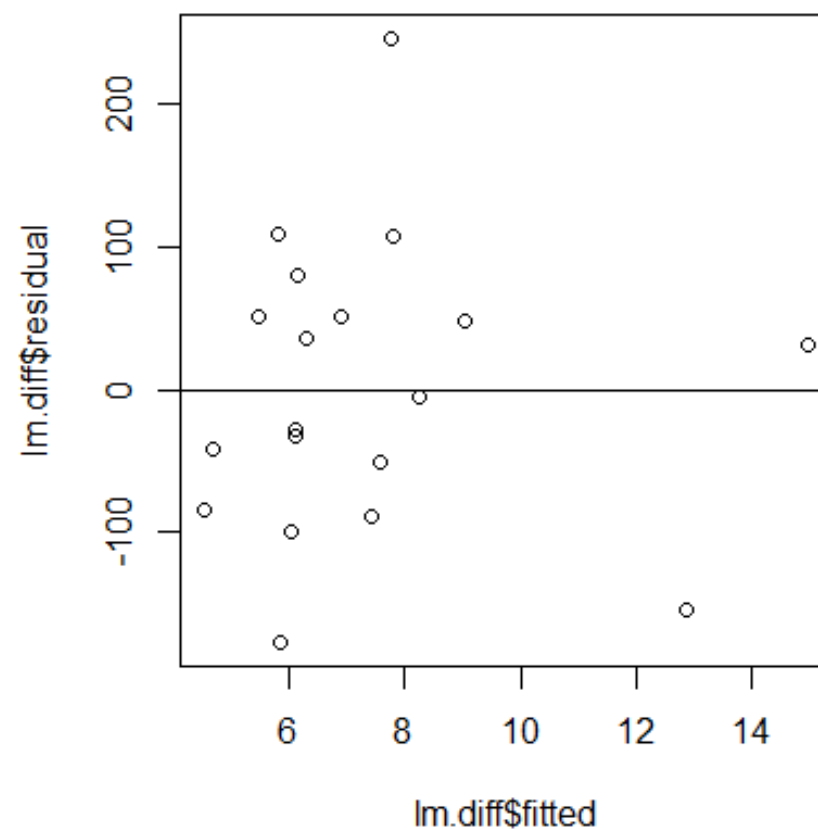
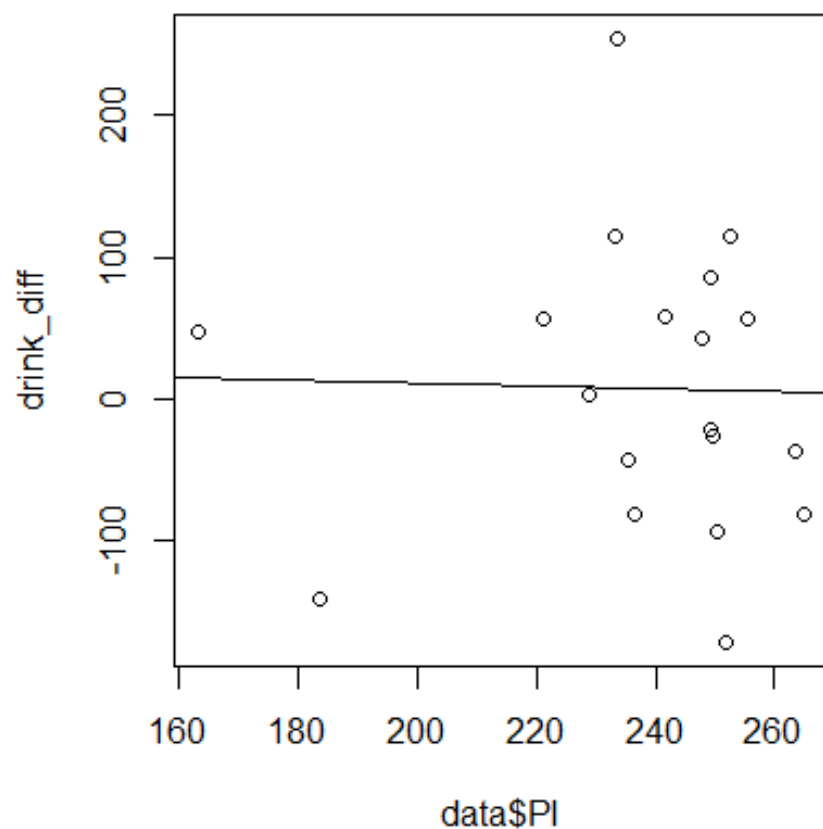


Assumptions:

Homoscedasticity: Non-constant Variance Score Test

p-value = 0.62855

Equal variance is not violated

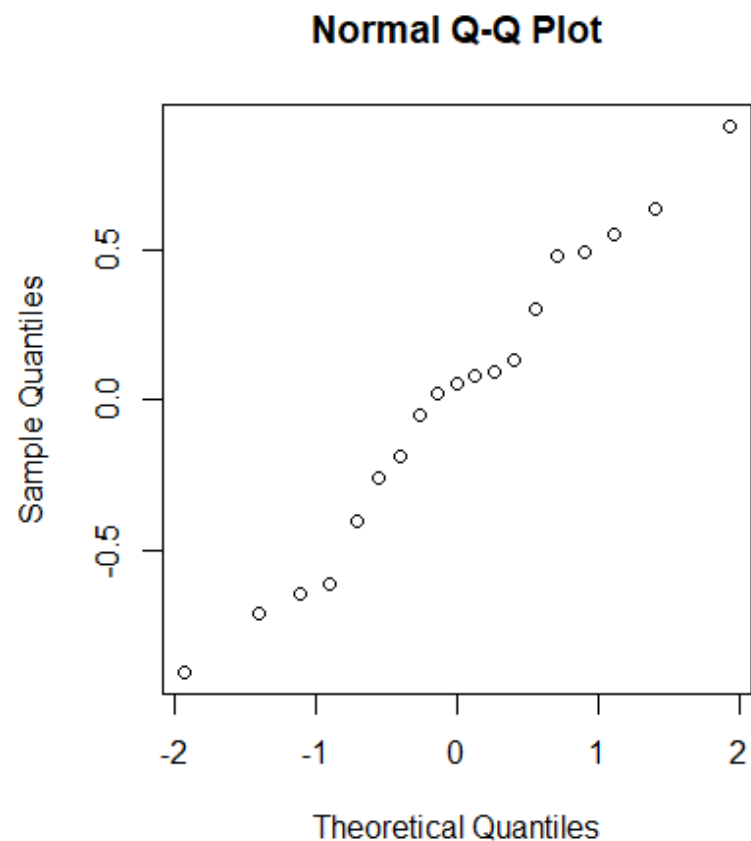
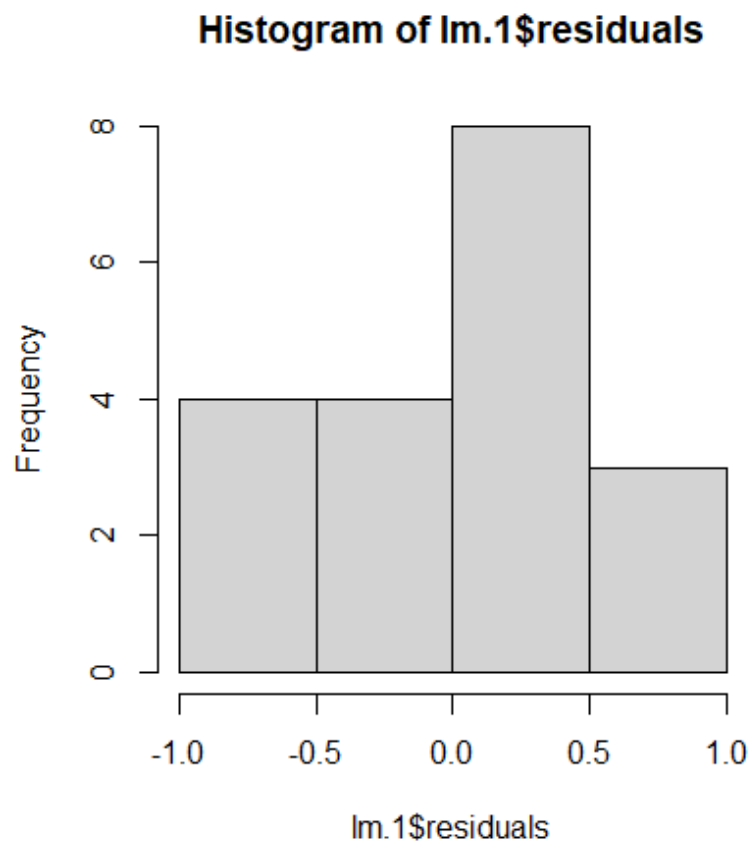


Assumptions:

Normality: Anderson-Darling normality test

p-value = 0.8115

Normality is not violated



Assumptions:

Independence: D-W test

p-value = 0.432

Independence is not violated

Homoscedasticity: Non-constant Variance Score Test

p-value = 0.62855

Equal variance is not violated

Normality: Anderson-Darling normality test

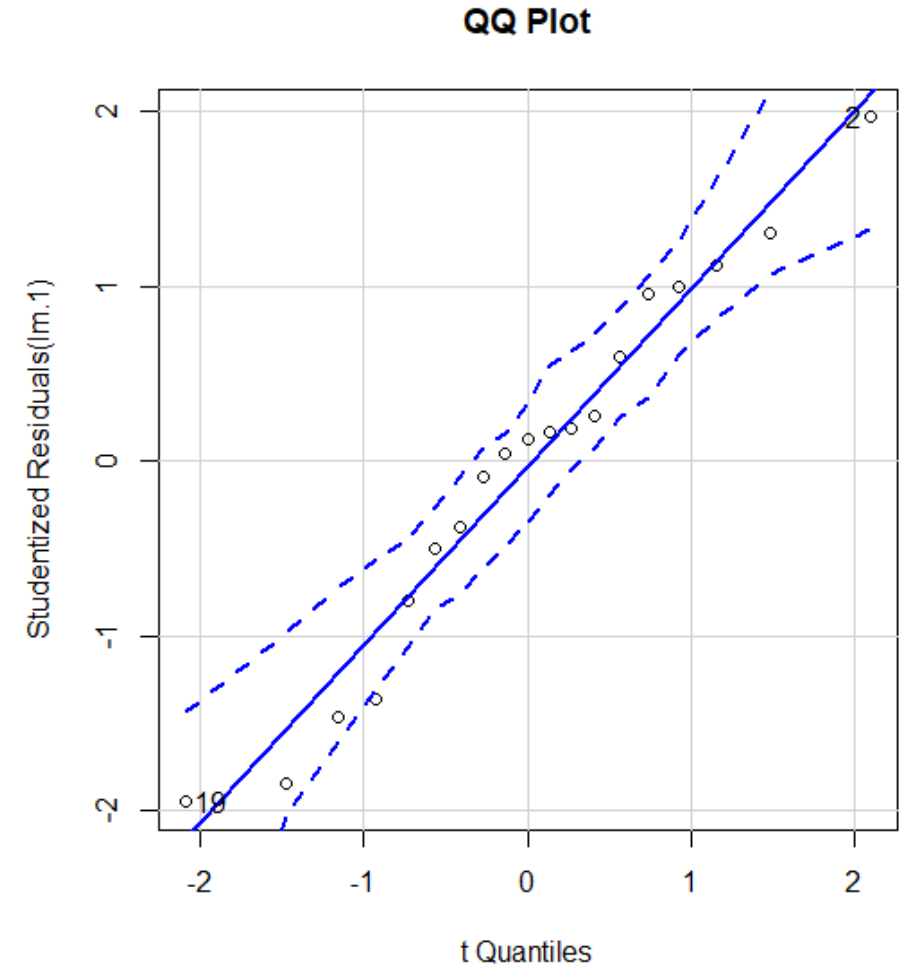
p-value = 0.8115

Normality is not violated

Linearity: Harvey-Collier test

p-value = 0.004825

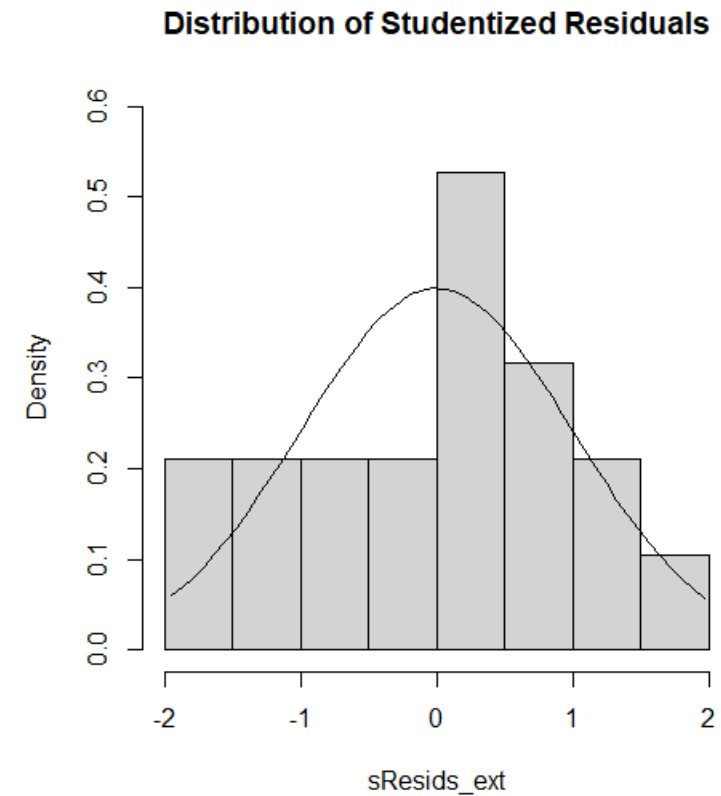
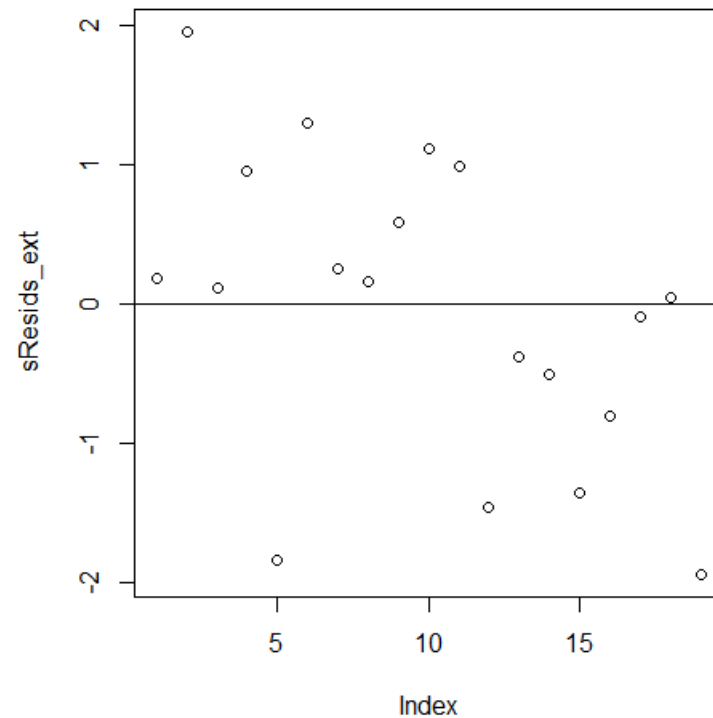
Violation of linearity – we could transform the data



Outliers and influential points

Outliers:

Studentized residuals : No studentized residuals with Bonferroni $p < 0.05$



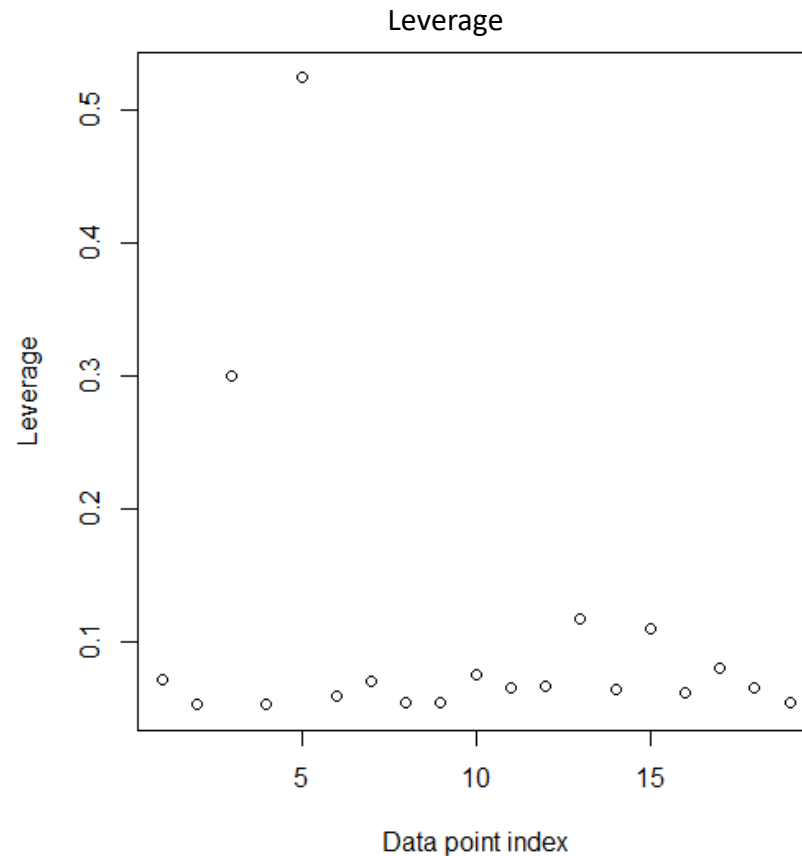
Outliers and influential points

Outliers:

Studentized residuals : No studentized residuals with Bonferroni $p < 0.05$

Leverage – Predictor Outlier:

Two data points 3 and 5



Outliers and influential points

Outliers:

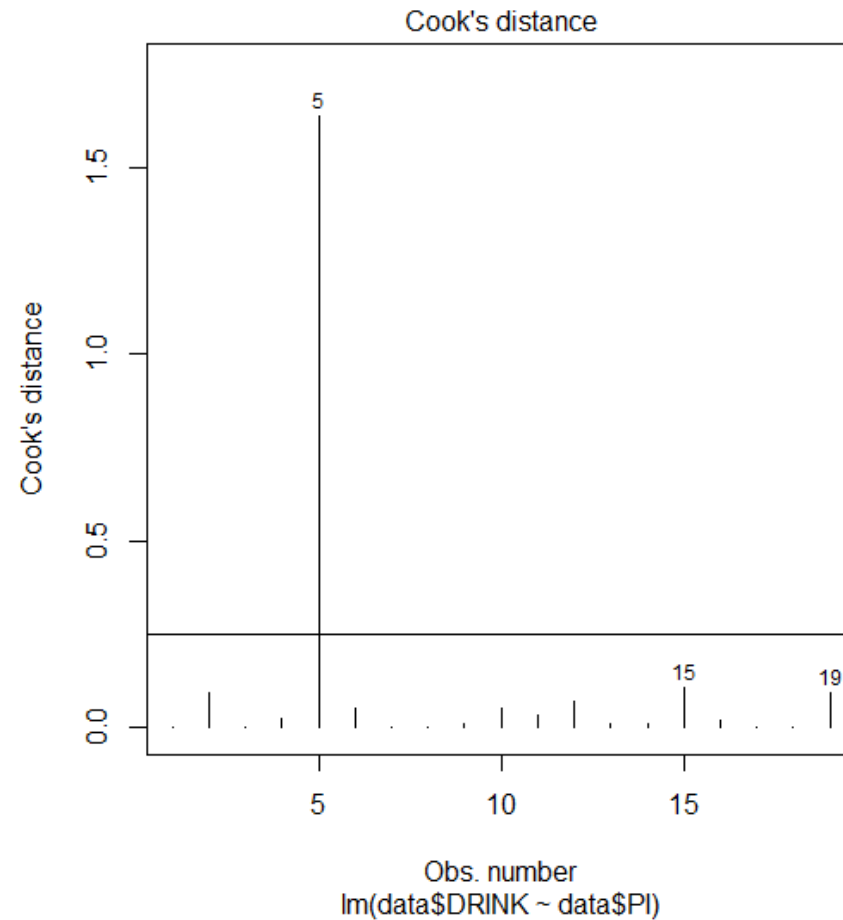
Studentized residuals : No studentized residuals with Bonferroni $p < 0.05$

Leverage – Predictor Outlier:

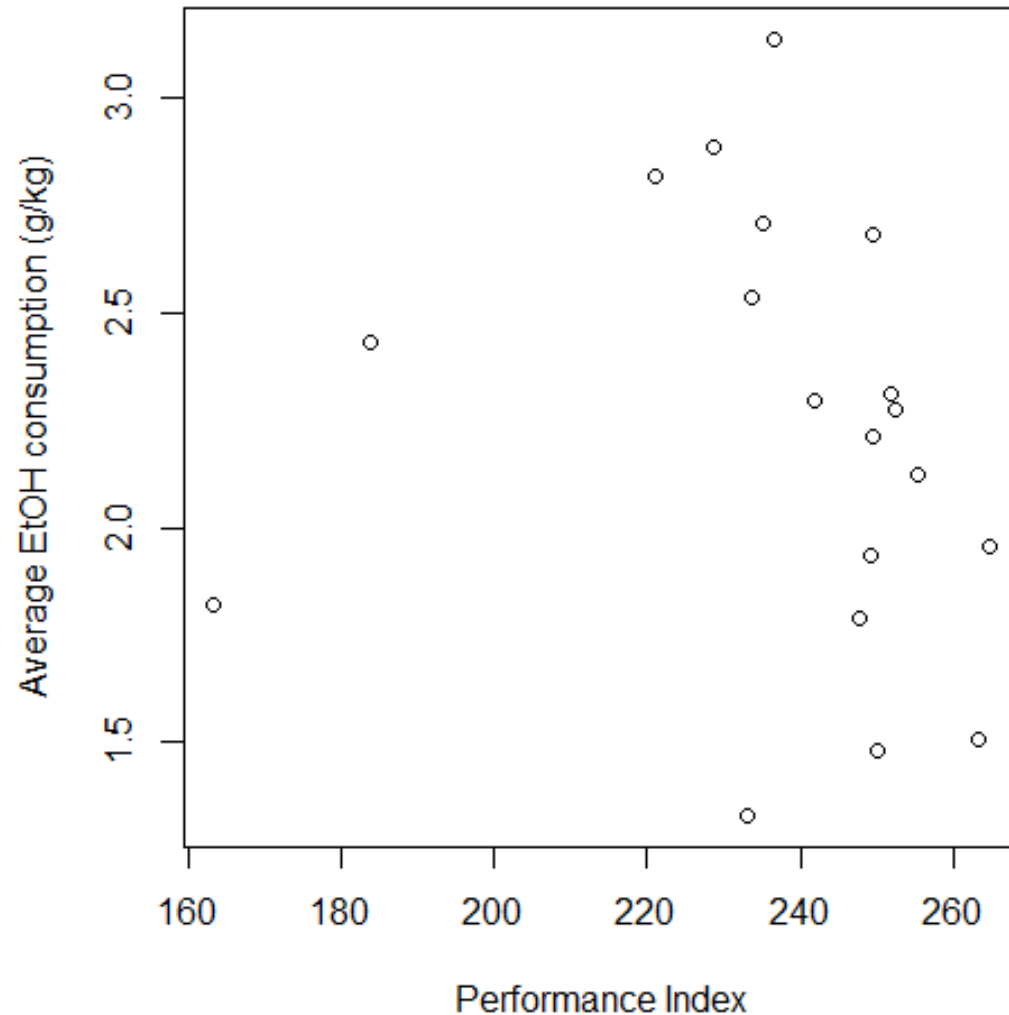
Two data points 3 and 5

Influential Points:

Cooks Distance: Data point 5



Correlation



Correlation: -0.1442282

P-value: 0.558

Increased performance index (higher cognitive performance) has a negative linear relationship with ethanol consumed. This correlation is not significant.

```
Pearson's product-moment correlation
data: data$PI and data$DRINK
t = -0.60095, df = 17, p-value = 0.5558
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.5616443  0.3317115
sample estimates:
      cor 
-0.1442282
```

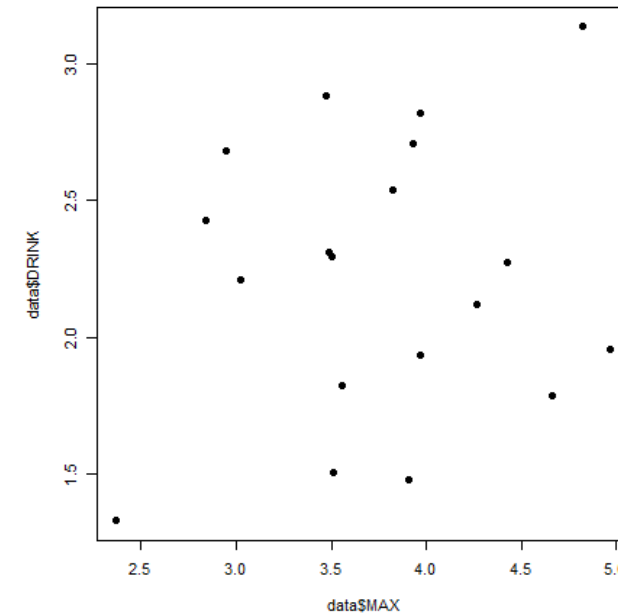
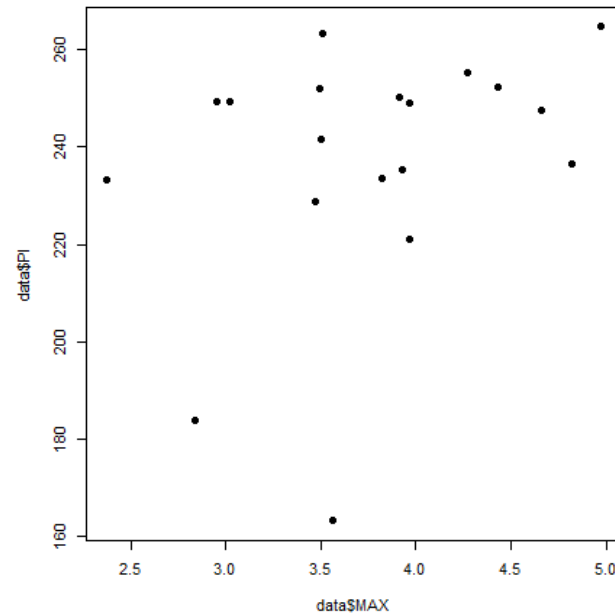
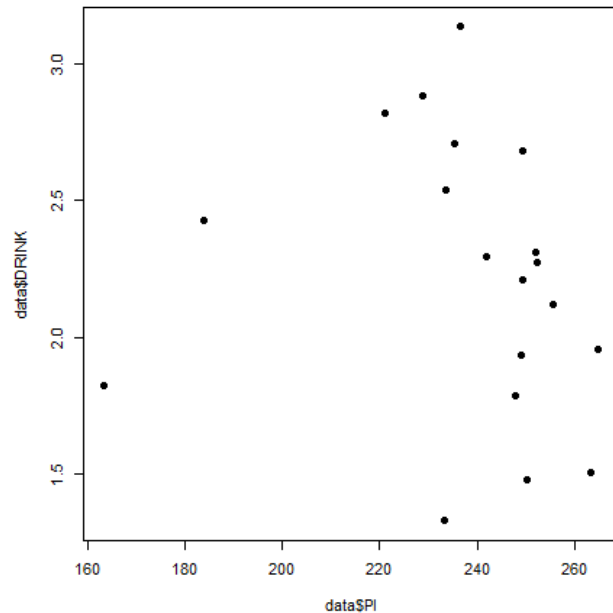
Partial Correlation

- Correlation of PI and average EtOH consumption controlling for maximum EtOH consumption
- There is a negative correlation for PI and average EtOH consumption when controlling for maximum EtOH consumption
- This correlation is not significant

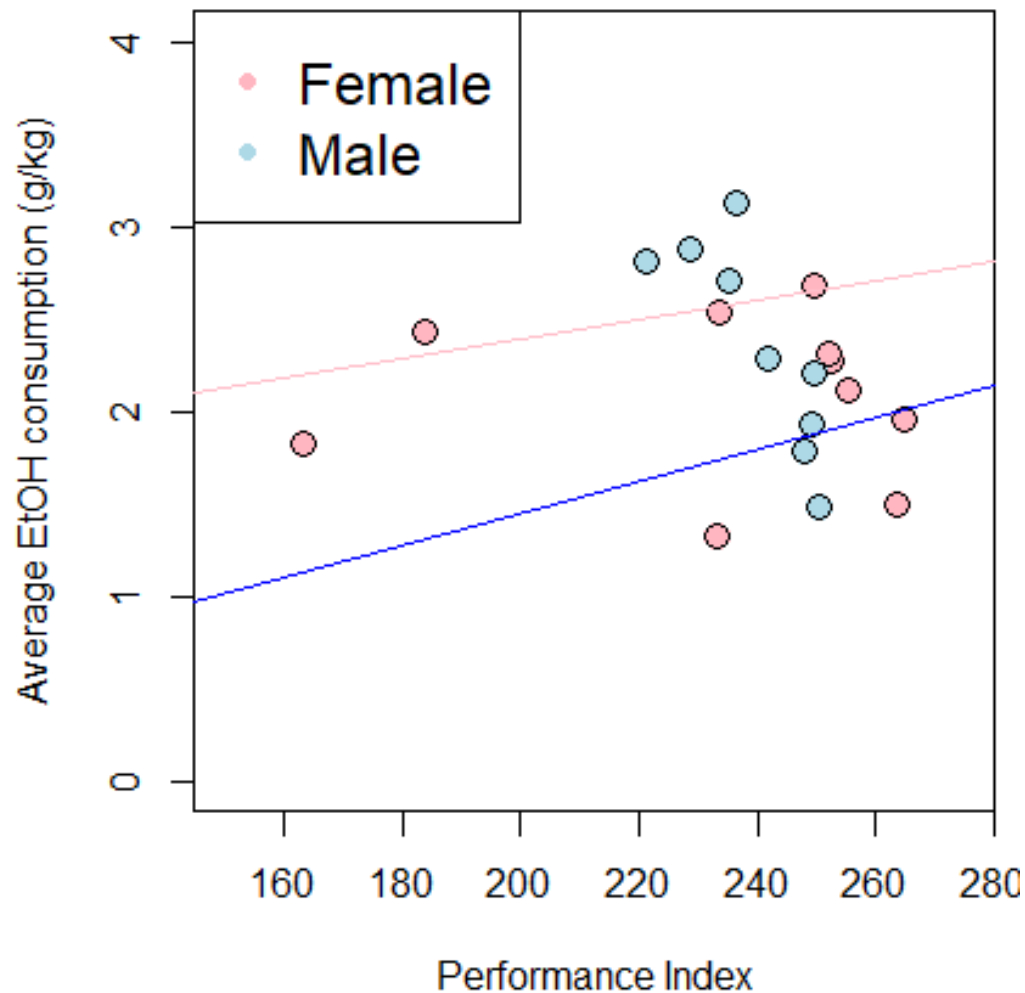
Partial Correlation:-0.210261

P-value: 0.4005948

```
> pcor.test(data$PI, data$DRINK, data$MAX)
      estimate    p.value statistic    n gp Method
1 -0.2110261 0.4005948 -0.8635512  19  1  pearson
```



Inference for two independent slopes



- Female & male mice will consume and escalate drinking at different rates
- There is a small positive correlation for PI and ethanol consumption for males and females
- The slopes are not significantly different from 0 or each other

Females:

correlation: 0.4054454
slope: 0.005261402
intercept: 1.337423
p-value: 0.2451

Males:

correlation: 0.1913489
slope: 0.008643212
intercept: - 0.282670
p-value: 0.6219

P-value: 1.009534

Bivariate Regression

Slope: -0.002862312

95% CI: (-0.0129113, 0.007186675)

P-value: 0.5507259

Fail to reject the null hypothesis that the slope is not different than 0

Intercept: 2.901429

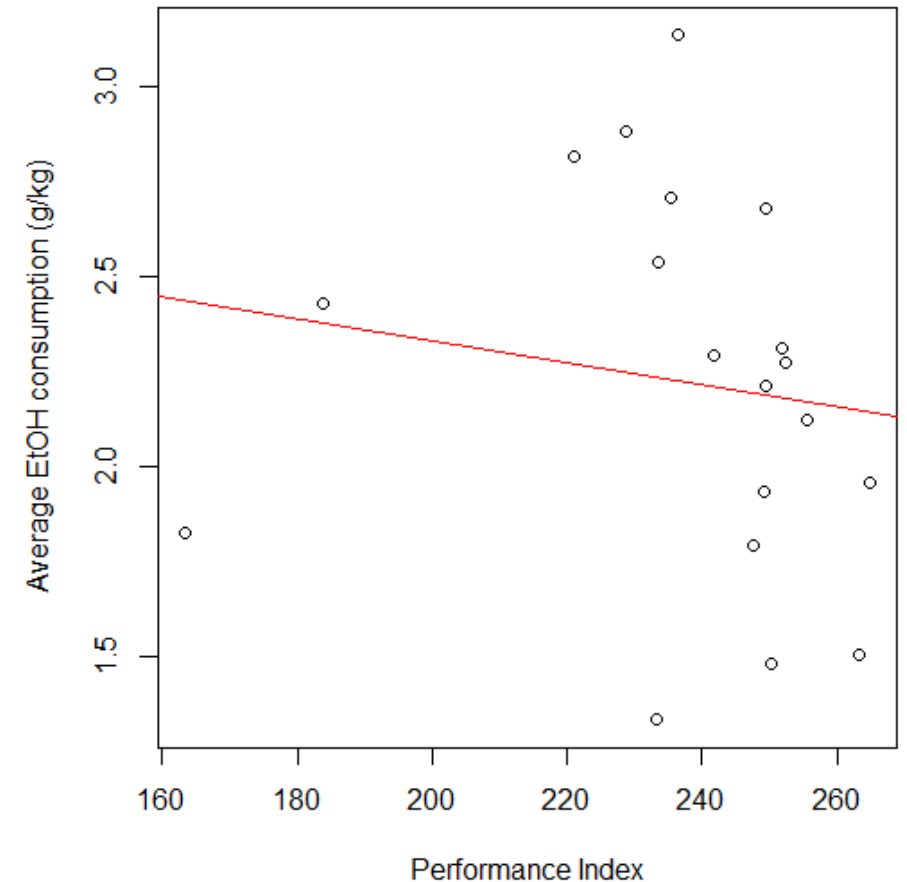
95% CI: (0.5027159, 5.300142490)

P-value: 0.0206325

Reject the null hypothesis that the intercept is not different than 0

If we had a PI of 210 we would expect:

Avg EtOH consumption = 2.300343g/kg



Conclusions

- This study was underpowered
- There was a negative correlation between PI and EtOH consumption
 - Not significant
- There was a partial negative correlation between PI and EtOH consumption when controlling for maximum EtOH consumption
 - Not significant
- There was no significant difference between the slopes of female and male PI x EtOH consumption