

Project R Code

Group 6

2024-06-03

```
#Power Anova Test and Sample Size
```

```
sugar <- rep(c(0, 0, 1, 1), 4)
caffeine <- rep(c(0, 1), 8)
block <- c(rep(1, 4), rep(2, 4), rep(3, 4), rep(4, 4))

response <- c(-0.2, -0.1, -0.4, -0.6,
              0.1, 0, -0.2, -0.2,
              -0.1, -0.1, -0.4, -0.4,
              -0.3, -0.1, -0.4, 0.1)

response <- response * -1
model_no_block <- aov(response ~ factor(sugar)*factor(caffeine))
model_block <- aov(response ~ factor(sugar)*factor(caffeine) + factor(block))
summary(model_no_block)
```

```
##                Df Sum Sq Mean Sq F value Pr(>F)
## factor(sugar)    1 0.1806 0.18063    5.522 0.0367 *
## factor(caffeine) 1 0.0156 0.01563    0.478 0.5026
## factor(sugar):factor(caffeine) 1 0.0006 0.00063    0.019 0.8923
## Residuals       12 0.3925 0.03271
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(model_block)
```

```
##                Df Sum Sq Mean Sq F value Pr(>F)
## factor(sugar)    1 0.18063 0.18063    6.359 0.0327 *
## factor(caffeine) 1 0.01563 0.01563    0.550 0.4772
## factor(block)     3 0.13688 0.04563    1.606 0.2554
## factor(sugar):factor(caffeine) 1 0.00062 0.00062    0.022 0.8853
## Residuals        9 0.25563 0.02840
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#no block
d <- 0.2
MSE <- 0.03271
#install.packages("pwr")
library(pwr)
pwr.anova.test(k = 4, f = d/sqrt(MSE), power = 0.9)
```

```
##
##      Balanced one-way analysis of variance power calculation
```

```
##
##           k = 4
##           n = 4.035544
##           f = 1.105833
##       sig.level = 0.05
##           power = 0.9
##
## NOTE: n is number in each group
```

```
# load the data
data <- read.csv("islands.csv")
head(data)
```

```
##   House      Name Sugar Caffeine Age.Block   Age B4 After
## 1   148  Jeremy Bager    0        0        1 0-14 6.4   6.2
## 2   262 Laurie Zaman    0        1        1 0-14 6.2   6.1
## 3   228 Adam Watanabe    1        0        1 0-14 6.6   6.2
## 4   491 Karlene Morris    1        1        1 0-14 7.7   7.1
## 5   376 Armand Bhatt     0        0        2 15-24 5.2   5.3
## 6   412 Ella Jensen     0        1        2 15-24 3.9   3.9
##   Vigilance.Test.Improvement Age.1
## 1                        0.2    12
## 2                        0.1    10
## 3                        0.4     8
## 4                        0.6     7
## 5                       -0.1    19
## 6                        0.0    22
```

```
# ANOVA without blocking
model1 <- aov(Vigilance.Test.Improvement ~ factor(Sugar)*factor(Caffeine), data = data)
summary(model1)
```

```
##               Df Sum Sq Mean Sq F value    Pr(>F)
## factor(Sugar)      1  1.4259   1.4259  43.650 2.5e-09 ***
## factor(Caffeine)    1  0.0126   0.0126   0.386  0.536
## factor(Sugar):factor(Caffeine) 1  0.0009   0.0009   0.029  0.866
## Residuals          92  3.0054   0.0327
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# anova with blocking
model2 <- aov(Vigilance.Test.Improvement ~ factor(Sugar)*factor(Caffeine) + factor(Age.Block), data = data)
summary(model2)
```

```
##               Df Sum Sq Mean Sq F value    Pr(>F)
## factor(Sugar)      1  1.4259   1.4259  43.104 3.37e-09 ***
## factor(Caffeine)    1  0.0126   0.0126   0.381  0.539
## factor(Age.Block)    3  0.0611   0.0204   0.616  0.606
## factor(Sugar):factor(Caffeine) 1  0.0009   0.0009   0.028  0.867
## Residuals          89  2.9443   0.0331
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## main effects
lm_model_no_block <- lm(Vigilance.Test.Improvement ~ Sugar * Caffeine, data = data)
lm_model_block <- lm(Vigilance.Test.Improvement ~ Sugar * Caffeine + Age.Block, data = data)
```

```
effect1 <- na.omit(2*coef(lm_model_no_block)[-1])
effect1
```

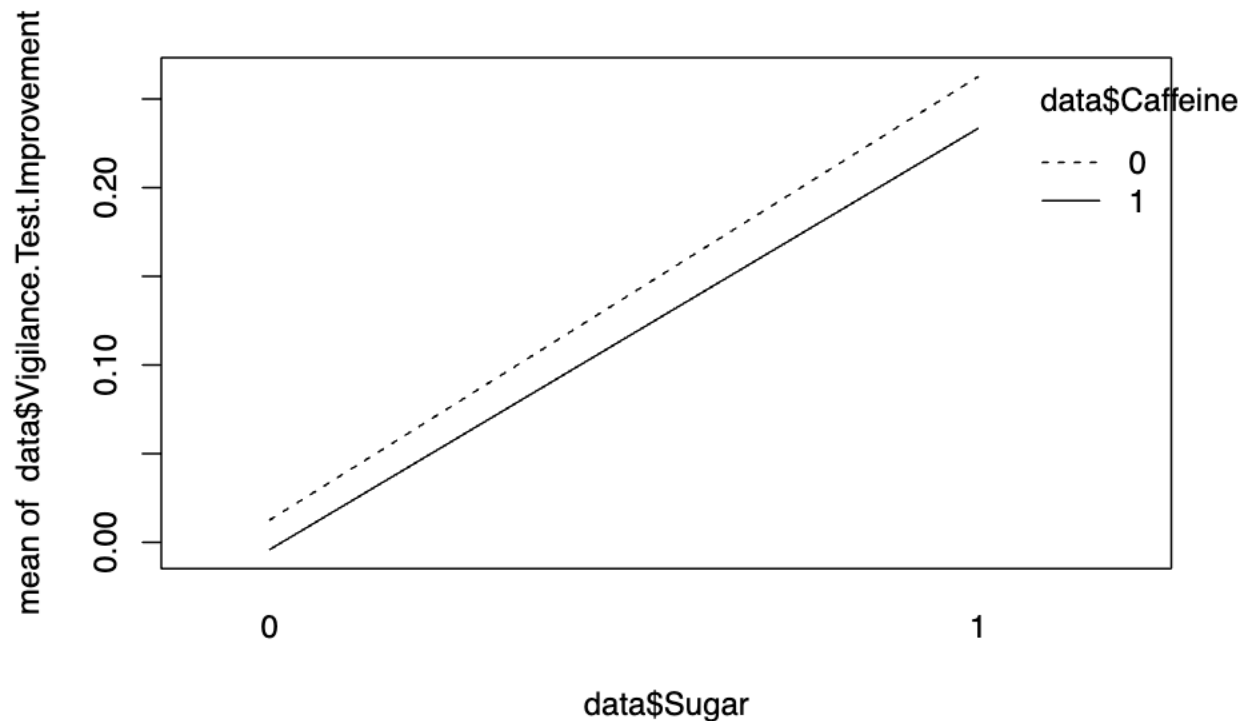
```
##          Sugar          Caffeine  Sugar:Caffeine
##  0.50000000  -0.03333333  -0.02500000
```

```
effect2 <- na.omit(2*coef(lm_model_block)[-1])
effect2
```

```
##          Sugar          Caffeine    Age.Block  Sugar:Caffeine
##  0.50000000  -0.03333333  -0.03583333  -0.02500000
```

```
#interaction plot
```

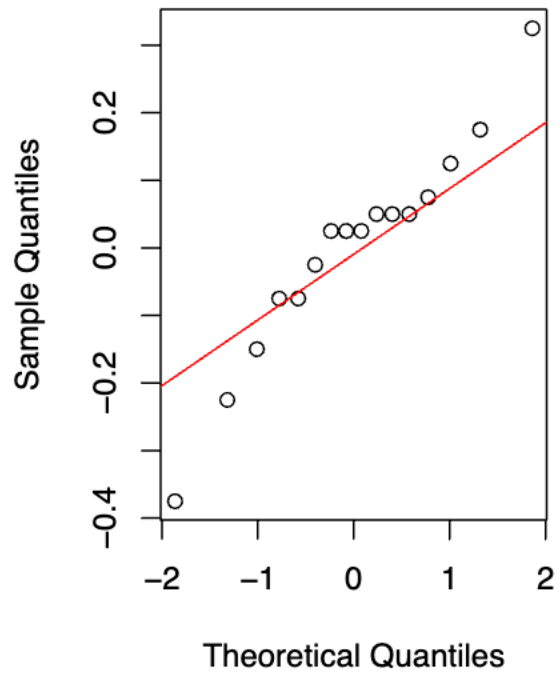
```
interaction.plot(data$Sugar, data$Caffeine, data$Vigilance.Test.Improvement)
```



```
# model assumptions
library(ggplot2)
par(mfrow = c(1, 2))
qqnorm(resid(model_no_block))
qqline(resid(model_no_block), col = "red")

plot(fitted(model_no_block), residuals(model_no_block),
     xlab = "Fitted Values", ylab = "Residuals",
     main = "Residual Plot")
abline(h = 0, col = "red")
```

Normal Q-Q Plot



Residual Plot

