Stat 425 Project 3

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Dataset

```
rt_data_ <- read.csv("C:/Users/chenh/Downloads/rt_data_.csv")
View(rt_data_)
attach(rt_data_)
React=data.frame(congruency,posture,reaction_time)
React
```

```
##      congruency posture reaction_time
## 1     congruent   stand      892.1429
## 2     congruent   stand      701.6111
## 3     congruent   stand     1009.7419
## 4     congruent   stand      734.6286
## 5     congruent   stand      904.8529
## 6     congruent   stand      955.9118
## 7     congruent   stand      879.2188
## 8     congruent   stand      872.3529
## 9     congruent   stand      876.3125
## 10    congruent   stand      797.3333
## 11    congruent   stand      732.4118
## 12    congruent   stand      929.1515
## 13    congruent   stand      739.1562
## 14    congruent   stand     1112.0882
## 15    congruent   stand      596.5758
## 16    congruent   stand      753.7714
## 17    congruent   stand      829.6857
## 18    congruent   stand      923.2500
## 19    congruent   stand      897.7576
## 20    congruent   stand      755.9143
## 21    congruent   stand      666.2286
## 22    congruent   stand      714.6286
## 23    congruent   stand      603.8571
## 24    congruent   stand     1042.2258
## 25    congruent   stand      793.3824
## 26    congruent   stand      784.0556
## 27    congruent   stand      724.6667
## 28    congruent   stand      811.1176
## 29    congruent   stand      768.0857
## 30    congruent   stand      900.4667
## 31    congruent   stand      688.2222
```

```
## 32     congruent    stand     835.8000
## 33     congruent    stand     751.7000
## 34     congruent    stand     884.7576
## 35     congruent    stand     752.1111
## 36     congruent    stand     741.9412
## 37     congruent    stand     705.2778
## 38     congruent    stand     756.7419
## 39     congruent    stand     870.4444
## 40     congruent    stand     750.1944
## 41     congruent    stand     857.5789
## 42     congruent    stand     793.5143
## 43     congruent    stand     940.1429
## 44     congruent    stand     815.9375
## 45     congruent    stand     677.1667
## 46     congruent    stand     823.3429
## 47     congruent    stand     728.9697
## 48     congruent    stand     721.4706
## 49     congruent    stand     811.6667
## 50     congruent    stand     788.4286
## 51   incongruent    stand    1016.5000
## 52   incongruent    stand     815.0857
## 53   incongruent    stand    1050.1333
## 54   incongruent    stand     819.4000
## 55   incongruent    stand    1016.1154
## 56   incongruent    stand     954.2727
## 57   incongruent    stand     981.0286
## 58   incongruent    stand     925.7667
## 59   incongruent    stand    1033.0882
## 60   incongruent    stand     932.8571
## 61   incongruent    stand     840.3611
## 62   incongruent    stand    1007.2121
## 63   incongruent    stand     914.7273
## 64   incongruent    stand    1178.7308
## 65   incongruent    stand     707.6667
## 66   incongruent    stand     851.6970
## 67   incongruent    stand     968.8857
## 68   incongruent    stand     998.4242
## 69   incongruent    stand     947.6471
## 70   incongruent    stand     878.2500
## 71   incongruent    stand     787.9118
## 72   incongruent    stand     829.5000
## 73   incongruent    stand     682.1471
## 74   incongruent    stand    1099.6667
## 75   incongruent    stand     871.5312
## 76   incongruent    stand     920.8333
## 77   incongruent    stand     862.8611
## 78   incongruent    stand     929.6250
## 79   incongruent    stand     841.8000
## 80   incongruent    stand    1109.8182
## 81   incongruent    stand     784.3714
## 82   incongruent    stand     878.0000
## 83   incongruent    stand     826.4000
## 84   incongruent    stand    1010.7059
## 85   incongruent    stand     754.5714
```

```
## 86  incongruent    stand    746.6111
## 87  incongruent    stand    771.9714
## 88  incongruent    stand    885.7353
## 89  incongruent    stand    941.9143
## 90  incongruent    stand    848.2353
## 91  incongruent    stand    933.1250
## 92  incongruent    stand    896.4375
## 93  incongruent    stand   1048.1852
## 94  incongruent    stand    982.4286
## 95  incongruent    stand    758.1714
## 96  incongruent    stand    844.5000
## 97  incongruent    stand    833.8571
## 98  incongruent    stand    849.7429
## 99  incongruent    stand   1020.6471
## 100 incongruent    stand    806.5000
## 101   congruent      sit   1031.9600
## 102   congruent      sit    610.4722
## 103   congruent      sit    949.8788
## 104   congruent      sit    636.3333
## 105   congruent      sit    902.7273
## 106   congruent      sit    839.3611
## 107   congruent      sit    945.0571
## 108   congruent      sit    883.5143
## 109   congruent      sit   1062.2400
## 110   congruent      sit    771.5833
## 111   congruent      sit    754.2941
## 112   congruent      sit    905.8571
## 113   congruent      sit    771.2353
## 114   congruent      sit   1031.3636
## 115   congruent      sit    660.1765
## 116   congruent      sit    777.6765
## 117   congruent      sit    949.8077
## 118   congruent      sit    912.0000
## 119   congruent      sit    983.6129
## 120   congruent      sit    755.7429
## 121   congruent      sit    759.0000
## 122   congruent      sit    727.6111
## 123   congruent      sit    634.4242
## 124   congruent      sit   1011.5938
## 125   congruent      sit    864.5278
## 126   congruent      sit    720.2778
## 127   congruent      sit    724.6111
## 128   congruent      sit    734.9697
## 129   congruent      sit    779.6857
## 130   congruent      sit    843.7241
## 131   congruent      sit    751.6000
## 132   congruent      sit    905.6364
## 133   congruent      sit    871.9130
## 134   congruent      sit    863.6333
## 135   congruent      sit    707.2286
## 136   congruent      sit    656.0833
## 137   congruent      sit    738.6765
## 138   congruent      sit    755.7059
## 139   congruent      sit    988.8286
```

```
## 140     congruent     sit      681.0000
## 141     congruent     sit      816.6333
## 142     congruent     sit      782.4375
## 143     congruent     sit     1025.3125
## 144     congruent     sit      829.3429
## 145     congruent     sit      708.0278
## 146     congruent     sit      776.3438
## 147     congruent     sit      768.7273
## 148     congruent     sit      789.7222
## 149     congruent     sit      943.7879
## 150     congruent     sit      800.2000
## 151 incongruent     sit     1090.7778
## 152 incongruent     sit      662.1944
## 153 incongruent     sit     1105.4545
## 154 incongruent     sit      866.5714
## 155 incongruent     sit     1024.0909
## 156 incongruent     sit      914.2812
## 157 incongruent     sit     1087.1471
## 158 incongruent     sit      926.7742
## 159 incongruent     sit     1213.2857
## 160 incongruent     sit      958.7500
## 161 incongruent     sit      872.1429
## 162 incongruent     sit     1032.5758
## 163 incongruent     sit      875.6875
## 164 incongruent     sit     1103.8125
## 165 incongruent     sit      723.5429
## 166 incongruent     sit      884.0000
## 167 incongruent     sit     1172.5862
## 168 incongruent     sit     1008.3333
## 169 incongruent     sit     1005.9130
## 170 incongruent     sit      812.9722
## 171 incongruent     sit      890.6562
## 172 incongruent     sit      918.8611
## 173 incongruent     sit      679.1818
## 174 incongruent     sit     1086.5806
## 175 incongruent     sit      959.0938
## 176 incongruent     sit      880.6944
## 177 incongruent     sit      869.7429
## 178 incongruent     sit      910.4000
## 179 incongruent     sit      890.5714
## 180 incongruent     sit     1040.1000
## 181 incongruent     sit      851.0857
## 182 incongruent     sit      994.6176
## 183 incongruent     sit      945.2381
## 184 incongruent     sit     1007.6786
## 185 incongruent     sit      764.9706
## 186 incongruent     sit      743.0294
## 187 incongruent     sit      879.2778
## 188 incongruent     sit      801.3548
## 189 incongruent     sit     1112.3939
## 190 incongruent     sit      867.8000
## 191 incongruent     sit      931.6667
## 192 incongruent     sit      842.7742
## 193 incongruent     sit     1198.3333
```

```
## 194 incongruent     sit      963.8000
## 195 incongruent     sit      849.2353
## 196 incongruent     sit      953.0833
## 197 incongruent     sit      912.4194
## 198 incongruent     sit      957.4722
## 199 incongruent     sit     1109.7407
## 200 incongruent     sit      886.5294
```

ANOVA test

```r
react.aov <- aov(reaction_time ~ congruency * posture, data = React)

print(react.aov)
```

```
## Call:
##    aov(formula = reaction_time ~ congruency * posture, data = React)
##
## Terms:
##                   congruency    posture congruency:posture Residuals
## Sum of Squares      576821.6    32303.5             6560.3 2585080.2
## Deg. of Freedom            1          1                  1       196
##
## Residual standard error: 114.8442
## Estimated effects may be unbalanced
```

```r
summary(react.aov)
```

```
##                     Df  Sum Sq Mean Sq F value    Pr(>F)
## congruency           1  576822  576822  43.734  3.49e-10 ***
## posture              1   32303   32303   2.449     0.119
## congruency:posture   1    6560    6560   0.497     0.481
## Residuals          196 2585080   13189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
e=residuals(react.aov)
fitted=fitted(react.aov)

fitted.react=cbind(rt_data_,e,fitted)

shapiro.test(e)
```
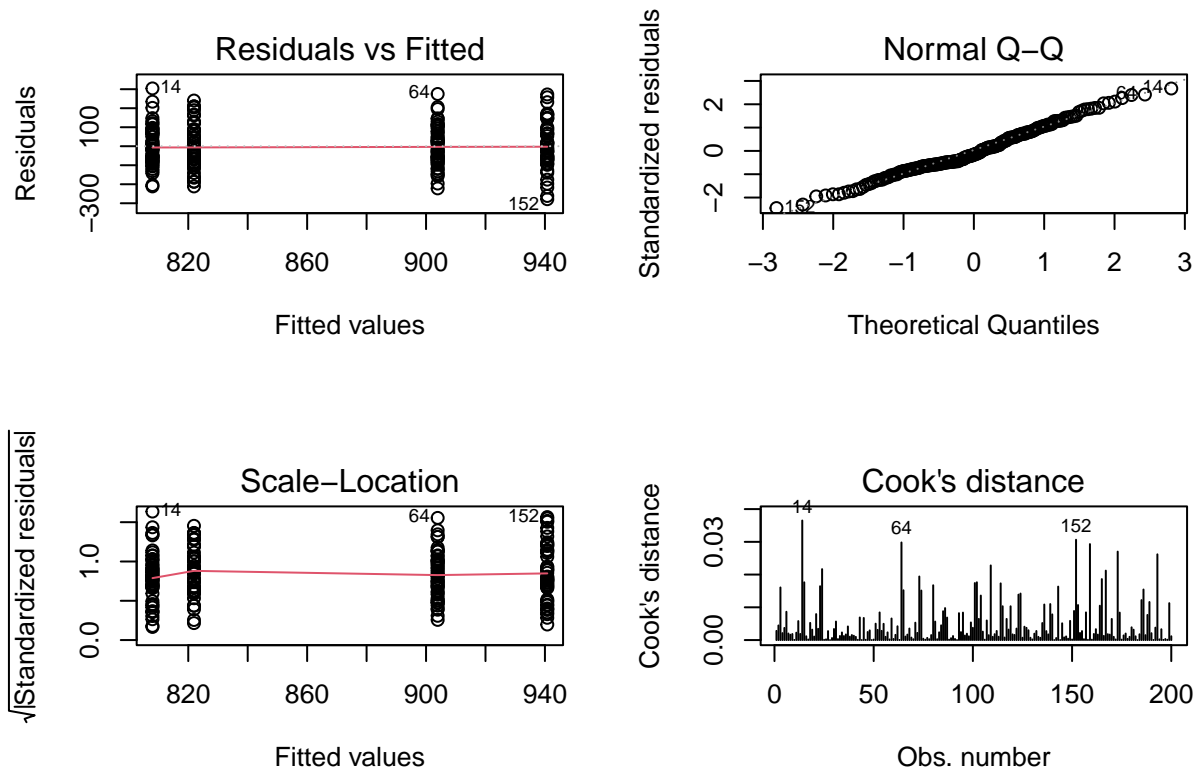
```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.98681, p-value = 0.05967
```

```
shapiro.test(reaction_time)
```

```
## 
##  Shapiro-Wilk normality test
## 
## data:  reaction_time
## W = 0.98797, p-value = 0.08915
```

QQplot

```
par(mfrow = c(2, 2))
plot(react.aov, 1:4)
```


Effects & r

```
effect_congruency= mean(reaction_time[congruency=="congruent"])-mean(reaction_time[congruency=="incongru
effect_congruency
```

```
## [1] -107.4078
```

```r
effect_posture =mean(reaction_time[posture=="stand"])-mean(reaction_time[posture=="sit"])
effect_posture
```

```
## [1] -25.41789
```

```r
effect_interaction= mean(c(reaction_time[congruency=="congruent" & posture=="stand"],reaction_time[cong
effect_interaction
```

```
## [1] 11.45455
```

```r
library(unrepx)
```

```
## Warning: package 'unrepx' was built under R version 4.2.3
```

```r
SSE=summary(react.aov)[[1]]$'Sum Sq'[4]
SSE
```

```
## [1] 2585080
```

```r
SST=sum(summary(react.aov)[[1]]$'Sum Sq')
SST
```
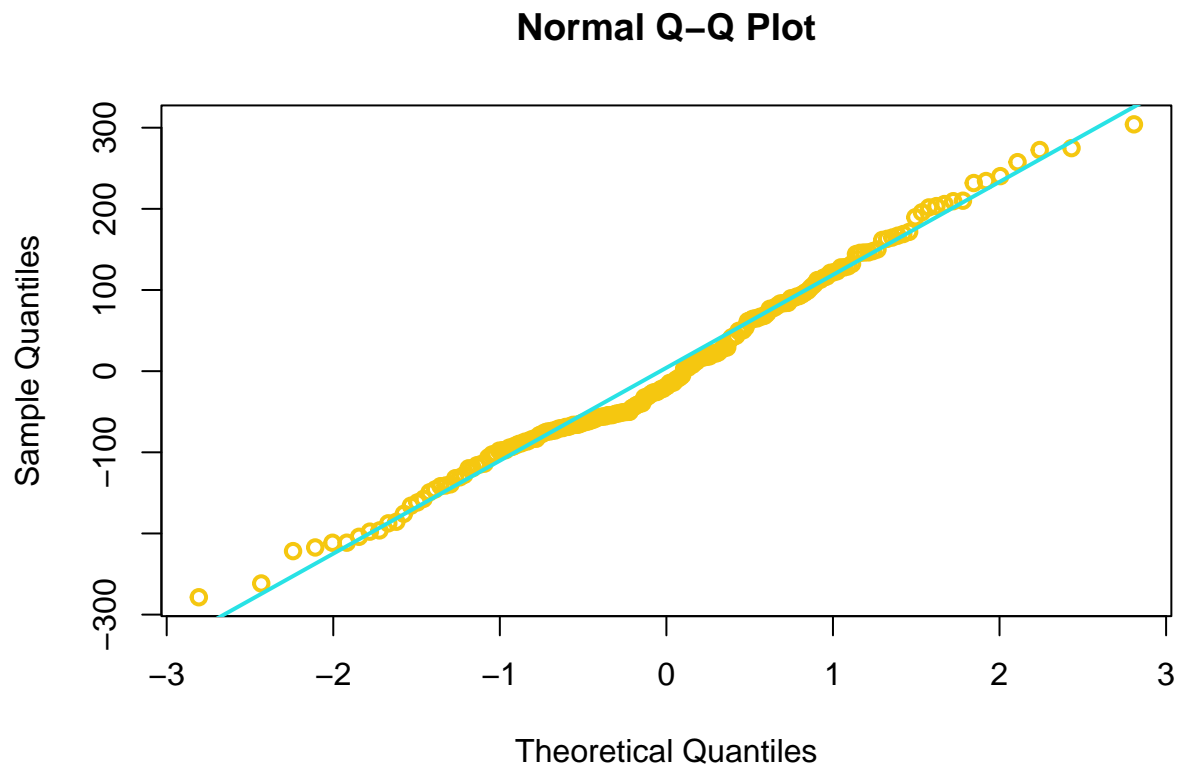
```
## [1] 3200766
```

```r
SSmodel=SST-SSE

Rsquare=SSmodel/SST
Rsquare
```

```
## [1] 0.1923557
```

Residual plot

```r
qqnorm(e,col=7,lwd=2)
qqline(e,col=5,lwd=2)
```

Normal Q–Q Plot

Equal variance

```r
library(car)
```

```
## Warning: package 'car' was built under R version 4.2.3
```

```
## Loading required package: carData
```

```
## Warning: package 'carData' was built under R version 4.2.3
```

```r
leveneTest(e,posture)
```

```
## Warning in leveneTest.default(e, posture): posture coerced to factor.
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1  1.4398 0.2316
##       198
```

```r
leveneTest(e,congruency)
```

```
## Warning in leveneTest.default(e, congruency): congruency coerced to factor.

## Levene's Test for Homogeneity of Variance (center = median)
##        Df F value Pr(>F)
## group   1   0.162 0.6877
##       198
```