## Loading libraries

library(ggplot2)

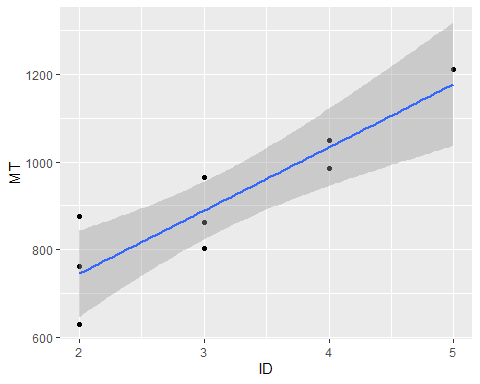
## Loading data

library(readxl)  
Data\_Mean\_128\_16\_first <- read\_excel("Data\_first\_experiment\_128\_16/Data\_Mean\_128\_16\_first.xlsx")  
Data\_128\_16\_first <- read\_excel("Data\_first\_experiment\_128\_16/Data\_128\_16\_first.xlsx")

## Plotting the data together with the linear regression

ggplot(Data\_Mean\_128\_16\_first, aes(ID, MT)) +  
 geom\_point() +  
 geom\_smooth(method='lm')

## `geom\_smooth()` using formula = 'y ~ x'



## Linear modelling

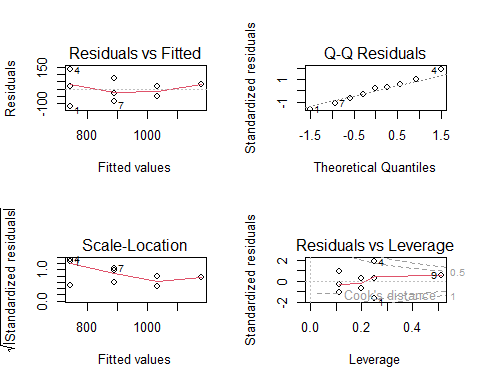
model1 <- lm(MT~ID, data = Data\_Mean\_128\_16\_first)  
summary(model1)

##   
## Call:  
## lm(formula = MT ~ ID, data = Data\_Mean\_128\_16\_first)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -115.0 -48.4 16.6 33.4 132.0   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 456.60 91.14 5.010 0.00155 \*\*  
## ID 144.20 27.90 5.168 0.00130 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 83.2 on 7 degrees of freedom  
## Multiple R-squared: 0.7923, Adjusted R-squared: 0.7626   
## F-statistic: 26.7 on 1 and 7 DF, p-value: 0.001299

#### Similary to Fitts’ law says, ID does seem to have an impact on the movement time.

#### Also, the R2=0.869 reported by the [experimental software](http://ergo.human.cornell.edu/FittsLaw/FittsLaw.html) and the R2=0.7923 I find here, are different.

par(mfrow=c(2,2));plot(model1);par(mfrow=c(1,1))



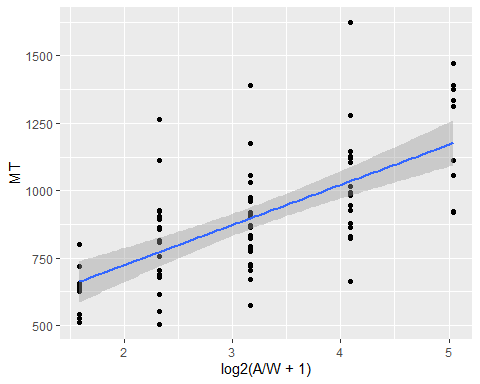
#### we can see from the residuLs VS Fitted there s no clear pattern (if i really undersant the pattern from this graph :) ),

#### so we will not reject this model , and we can consider it good , also the pvalue it is inder 0.05 .

#### note this data for the mean not the raw.

ggplot(Data\_128\_16\_first, aes(log2(A/W+ 1), MT)) +  
 geom\_point() +  
 geom\_smooth(method='lm')

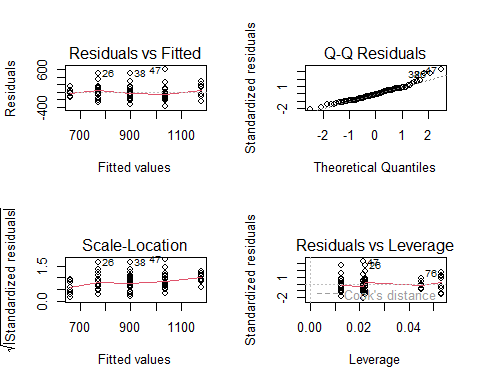
## `geom\_smooth()` using formula = 'y ~ x'



model2 <- lm(MT~ log2(A/W + 1), data = Data\_128\_16\_first)  
summary(model2)

##   
## Call:  
## lm(formula = MT ~ log2(A/W + 1), data = Data\_128\_16\_first)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -370.69 -122.14 -18.69 109.31 589.31   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 426.25 67.83 6.284 1.68e-08 \*\*\*  
## log2(A/W + 1) 148.86 20.12 7.399 1.28e-10 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 182.3 on 79 degrees of freedom  
## Multiple R-squared: 0.4093, Adjusted R-squared: 0.4018   
## F-statistic: 54.75 on 1 and 79 DF, p-value: 1.278e-10

par(mfrow=c(2,2));plot(model2);par(mfrow=c(1,1))

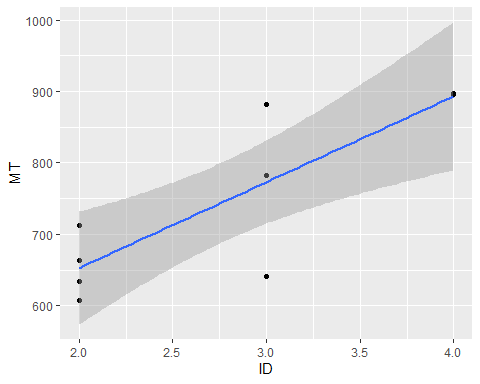


#### from the ploting graph we cant see there is a real impact from ID on MT , but for the model we can see the fitted vs residuals we cant reject the model and we can see the p value less than 0.05 which is good so we can go with this model , but the movement values will not just depend on ID , there are factors like the device we use , the age of person , how much he concetrate , does he diid somthing else while he doing the experiment , does he use mouse or something else.

library(readxl)  
Data\_Mean\_12\_6\_second <- read\_excel("Data\_second\_experiment\_12\_6/Data\_Mean\_12\_6\_second.xlsx")  
Data\_12\_6\_second <- read\_excel("Data\_second\_experiment\_12\_6/Data\_12\_6\_second.xlsx")

ggplot(Data\_Mean\_12\_6\_second, aes(ID, MT)) +  
 geom\_point() +  
 geom\_smooth(method='lm')

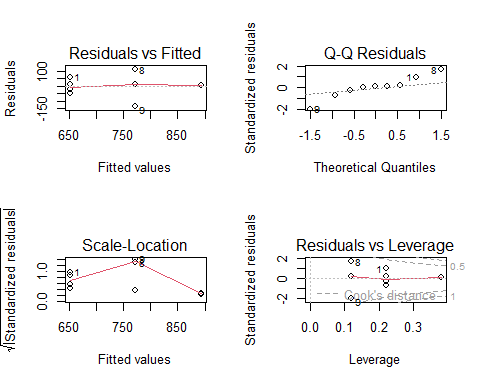
## `geom\_smooth()` using formula = 'y ~ x'



model3 <- lm(MT~ID, data = Data\_Mean\_12\_6\_second)  
summary(model3)

##   
## Call:  
## lm(formula = MT ~ ID, data = Data\_Mean\_12\_6\_second)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -131.92 -18.78 3.94 11.22 109.08   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 412.50 87.09 4.736 0.00212 \*\*  
## ID 120.14 30.17 3.982 0.00531 \*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 71.11 on 7 degrees of freedom  
## Multiple R-squared: 0.6937, Adjusted R-squared: 0.65   
## F-statistic: 15.86 on 1 and 7 DF, p-value: 0.00531

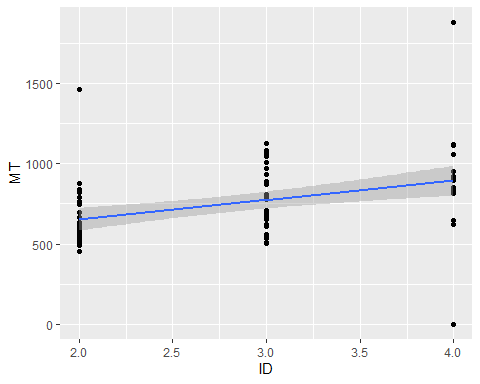
par(mfrow=c(2,2));plot(model3);par(mfrow=c(1,1))



#### also from this graph residual vs fitted so we cant pattern so we cant reject the model , and there is a little impact from the ID on th MT but As I said above there another factors.

ggplot(Data\_12\_6\_second, aes(ID, MT)) +  
 geom\_point() +  
 geom\_smooth(method='lm')

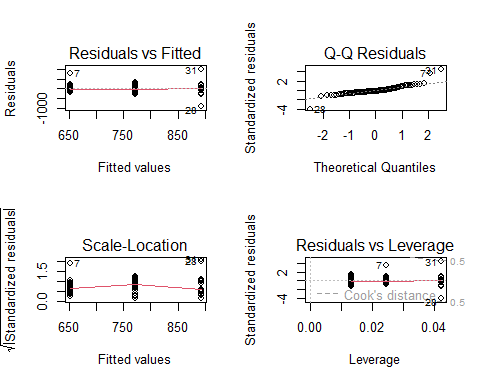
## `geom\_smooth()` using formula = 'y ~ x'



model4 <- lm(MT~ ID, data = Data\_12\_6\_second)  
summary(model4)

##   
## Call:  
## lm(formula = MT ~ ID, data = Data\_12\_6\_second)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -892.72 -116.69 -44.69 99.29 987.28   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 412.67 93.35 4.421 3.1e-05 \*\*\*  
## ID 120.01 32.34 3.711 0.000382 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 228.7 on 79 degrees of freedom  
## Multiple R-squared: 0.1485, Adjusted R-squared: 0.1377   
## F-statistic: 13.77 on 1 and 79 DF, p-value: 0.0003823

par(mfrow=c(2,2));plot(model4);par(mfrow=c(1,1))



#### we can’t reject the model here, but ID does not impact MT on the opposite of Fitts’ law.