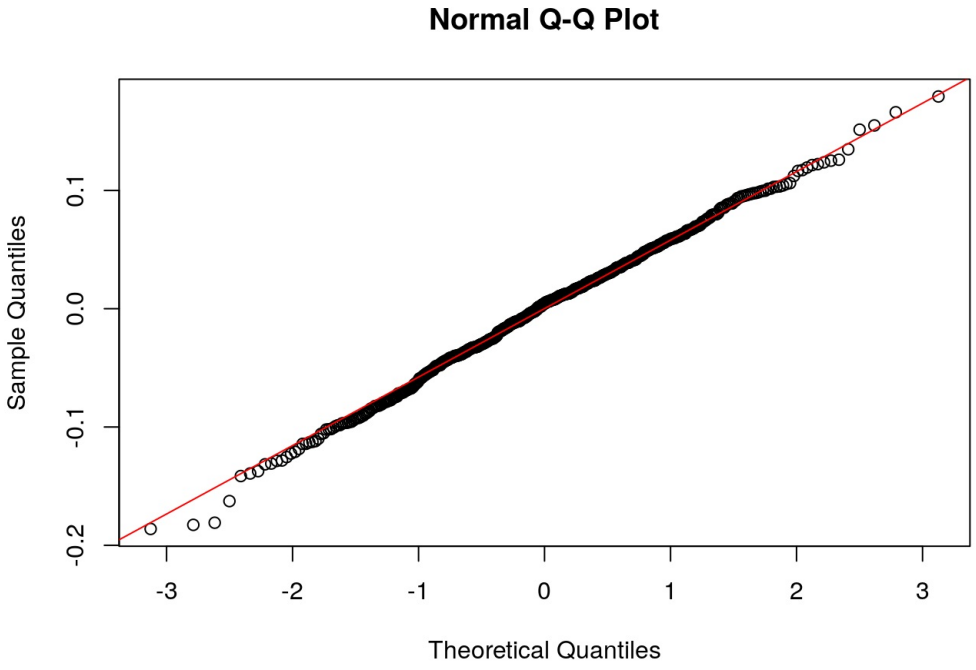
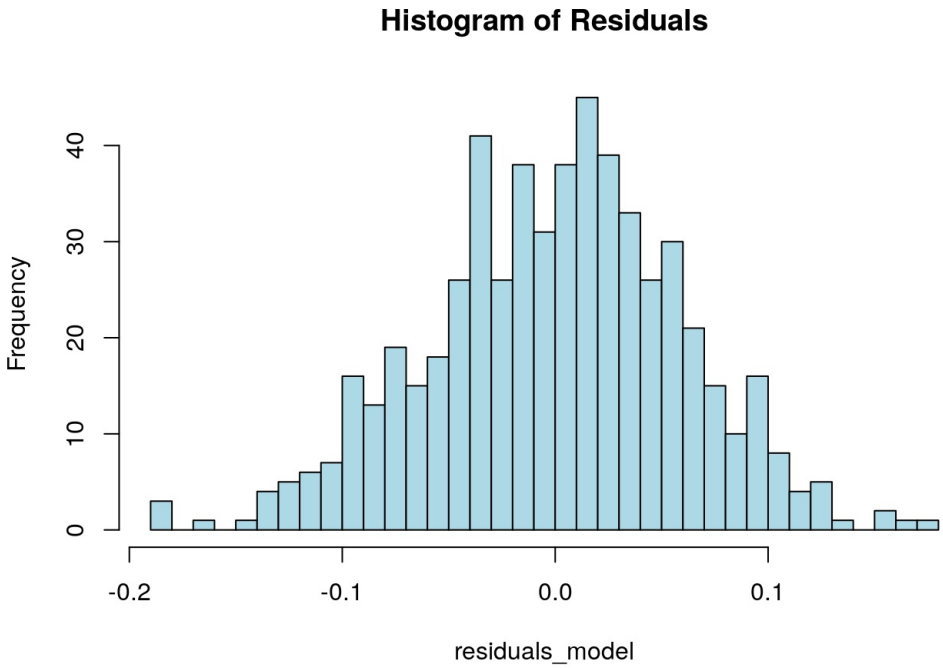
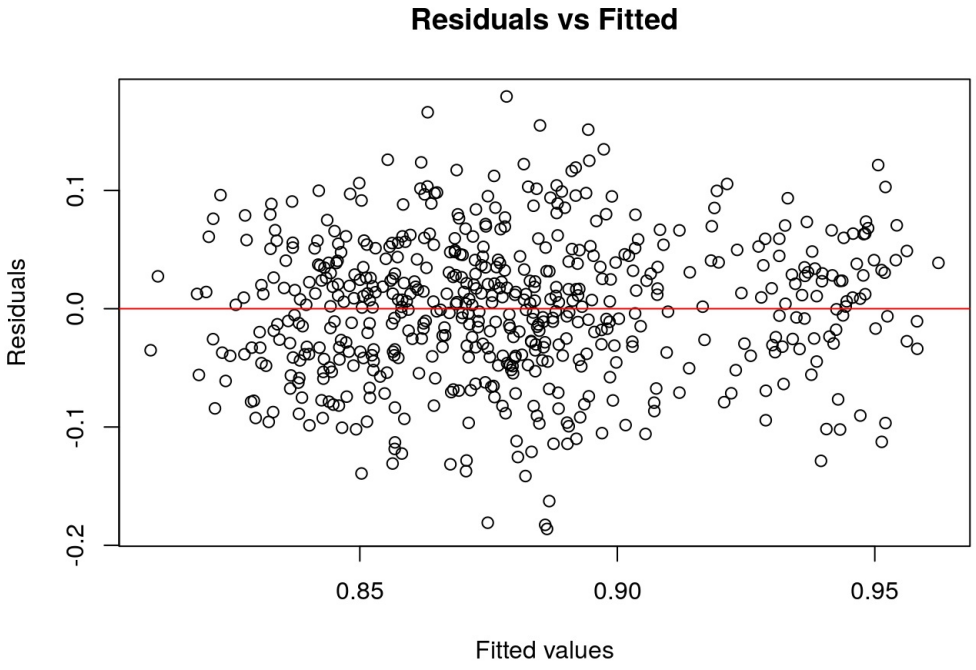


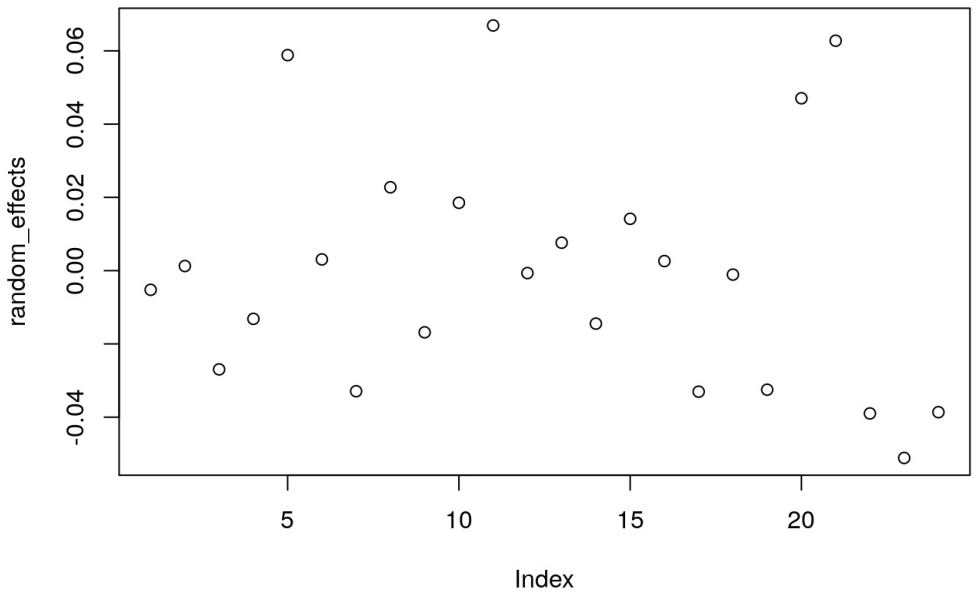

```
# I will create a histogram of residuals to visually inspect the residuals.

hist(residuals_model, main = "Histogram of Residuals", breaks = 50, col = "lightblue", border = "black")
```



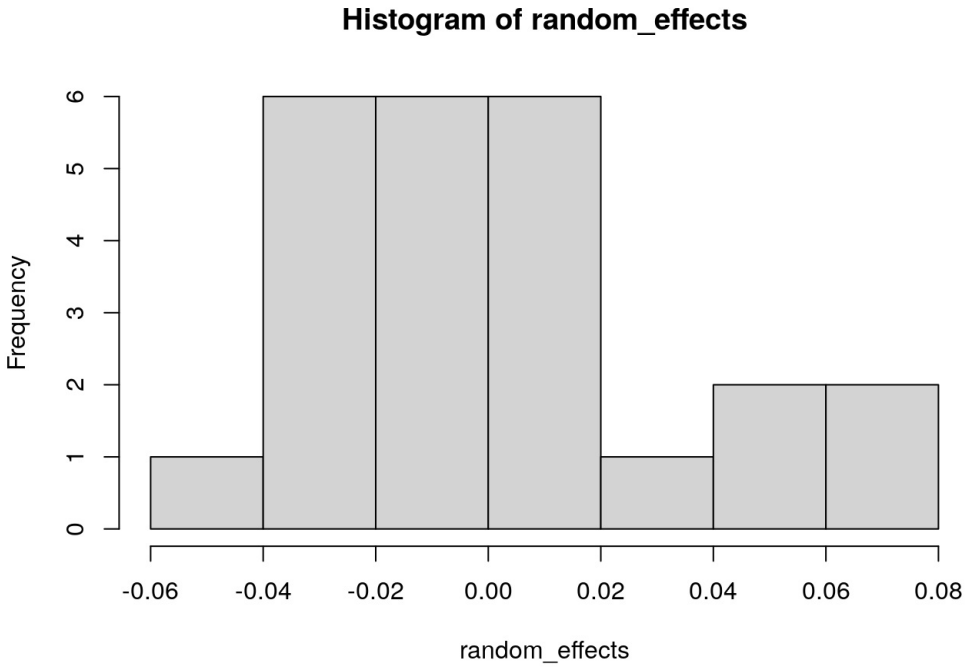

```
# Below is a residuals vs fitted values plot to check if the data is homoscedastic and the relationship between t
he dependent variables and the independent variables is linear. For these assumptions to be met, there must not b
e a specific shape in the plot (they should be scattered randomly).

plot(fitted(model), resid(model),
     main = "Residuals vs Fitted",
     xlab = "Fitted values",
     ylab = "Residuals")
abline(h = 0, col = "red")
```



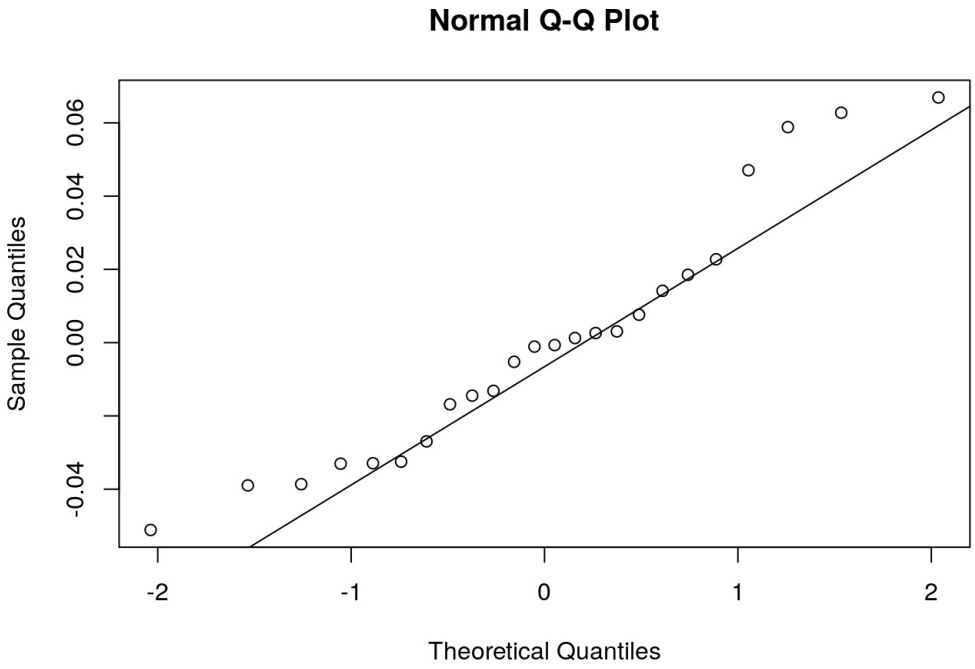

```
# One assumption is that the random intercepts have to be normal. Below I will get the random intercepts of my mo
del and plot them using a histogram and a QQ-plot to see if they are normally distributed visually. Then I will r
un a Shapiro-Wilk test to confirm the normality if the p-value is above the conventional threshold of 0.05. I wil
l also check that the mean of the random intercepts is 0 as this is another assumption.

random_effects <- ranef(model)$ID[, 1]
random_effects <- as.numeric(random_effects)

plot(random_effects)
```




```
hist(random_effects)
```




```
qqnorm(random_effects)
qqline(random_effects)
```




```
mean(random_effects)
```

```
## [1] -5.264339e-15
```

```
shapiro.test(random_effects)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  random_effects
## W = 0.93481, p-value = 0.1249
```

```
# The model is a mixed-effects model. The REML criterion is used to determine how well the model fits the data, b
ut it is primarily used to compare different models, with low values indicating a better fit.

# In relation to random effects, i.e. differences between participants, the model indicates that there is some va
riability in the reaction times of different participants (variance = 0.0012), but this difference is fairly smal
l. In addition, the residual or within-subject variance (variance = 0.0037) is larger than the between-subject va
riance.

# The model indicates that the intercept is significant with a p-value well below 0.05 and that there is a signif
icant effect of word count and readability in headlines on reaction time when identifying headlines, with p-value
s of 0.0336 and 0.00981, respectively. The estimate shows the strength and direction of the relationship, but as
I used inverse reaction time, the direction is the opposite when measured in non-transformed reaction time. There
fore, as word count increases, reaction time increases and as readability increases, reaction time decreases. Mor
eover, there is not a significant effect of polarity and subjectivity on reaction time, as is reflected in p-valu
es of 0.362 and 0.298, respectively, as they are above the significance threshold of 0.05 in both cases. I got th
e p-values by converting the t-values I obtained in the summary.

# In the correlation of fixed effects section, it can be seen that no predictor variables are correlated to an al
arming extent. I will note that readability and subjectivity are fairly correlated, with a correlation value of 0
.607. However, this is not too excessive and should not pose a problem. This assumption is therefore met.

# The residuals of this model are normally distributed, with a p-value of 0.5534 in the Shapiro-Wilk test. The QQ
-plot and the histogram also support this visually. Therefore, this assumption is met.

# The assumption of independence of observations is also met because each participant individually completed the
experiment without any overlap or contamination of other participants.

# The assumption of homoscedasticity is met because the residuals vs fitted plot does not display any specific pa
ttern except for the residuals spreading out slightly around the middle. The fact that our residuals are normally
distributed buttresses this notion.

# The absence of a clear trend or shape in the residuals vs fitted plot means that the assumption of linearity be
tween the dependent variable and the independent variables being linear is met.

# The random intercepts are normally distributed, as can be seen through the histogram and QQ-plot random effects
. The mean of the random intercepts is 0. The p-value of the random intercepts further supports the idea that the
random effects are normally distributed. Therefore, the assumption of normal random intercepts with a mean of 0 i
s met.

# As a result, I will conclude that all the required assumptions are met and the results should be reliable.

# The variables of polarity and subjectivity do not have a significant influence on reaction time. Subjectivity i
s moderately correlated with readability. This model is adequate because it includes all four variables (word cou
nt, readability, polarity and subjectivity). However, other models fit the data better (measured using REML conve
rgence, AIC and BIC), so I will explore them.

# Now I will get the AIC and BIC values of this model to compare it to others to know which one fits the data bes
t, knowing that lower values signify a better fit.

AIC(model)
```

```
## [1] -1448.467
```

```
BIC(model)
```

```
## [1] -1418.11
```

```
# In the case of REML convergence, this model has a value of -1462.5.

# In the case of AIC and BIC scores, this model has values of -1448.46 and -1418.11, respectively.

# Below I will plot the relationship between reaction time and word count, and reaction time and readability to s
ee if it matches my above-mentioned conclusion.

ggplot(df, aes(x = n_number_of_words, y = n_reaction_time)) +
  geom_point(alpha = 0.6, color = "blue") +
  geom_smooth(method = "lm", color = "red", se = FALSE) +
  labs(
    title = "Reaction Time vs. Number of Words",
    x = "Number of Words",
    y = "Reaction Time (s)"
  ) +
  theme_minimal()
```


```
ggplot(df, aes(x = n_readability, y = n_reaction_time)) +
  geom_point(alpha = 0.6, color = "blue") +
  geom_smooth(method = "lm", color = "red", se = FALSE) +
  labs(
    title = "Reaction Time vs. Readability",
    x = "Readability",
    y = "Reaction Time (s)"
  ) +
  theme_minimal()
```


```
# In the model above, the variables of polarity and subjectivity are not significant (see t-values, and their con
version into p-values) and readability and subjectivity are mildly correlated. Therefore, I will exclude polarity
and subjectivity.

model_simple <- lmer(inverse_power_rt ~ number_of_words + readability + (1|ID), data = df)

summary(model_simple)
```