

ANOVA_models

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```
# Clear environment
rm(list = ls())

# Load packages
library(readxl)
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --

## v ggplot2 3.3.3      v purrr  0.3.4
## v tibble  3.0.5      v dplyr  1.0.3
## v tidyr   1.1.2      v stringr 1.4.0
## v readr   1.4.0      v forcats 0.5.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

library(broom)      # For tidy() to make better anova summary
library(knitr)       # For better tables

# Read in data
AS_raw <- read_excel("Data/AlkaSeltzer_Results.xlsx")

# Global options
```

Data cleaning

```
AS <-
  AS_raw %>%
  mutate(Volume = as.factor(Volume))
```

ANOVA model

```
# Start with the full model with 2 and 3 way interactions
full_aov <-
  aov(Time ~ Temp + Liquid + Volume + Temp:Liquid + Temp:Volume + Liquid:Volume + Temp:Liquid:Volume,
       data = AS)

# Conduct the stepwise selection
step_aov <- step(full_aov, trace = FALSE)

# Better anova summary table
step_aov %>%
  tidy() %>%
  kable(digits = 3)
```

term	df	sumsq	meansq	statistic	p.value
Temp	1	50896.488	50896.488	206.809	0.000
Liquid	1	3092.750	3092.750	12.567	0.004
Residuals	13	3199.353	246.104	NA	NA

Tukey Comparisons

```
TukeyHSD(step_aov, "Temp", conf.level = 0.95)
```

```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = Time ~ Temp + Liquid, data = AS)
##
## $Temp
##           diff          lwr          upr p adj
## Room-Fridge -112.8012 -129.7469 -95.85564    0
```

```
TukeyHSD(step_aov, "Liquid", conf.level = 0.95)
```

```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = Time ~ Temp + Liquid, data = AS)
##
## $Liquid
##           diff          lwr          upr    p adj
## Water-Sprite -27.80625 -44.75186 -10.86064 0.0035908
```

```
TukeyHSD(step_aov, "Temp", conf.level = 0.95) %>%
  tidy() %>%
  select(-null.value) %>%
  kable(digits = 2)
```

term	contrast	estimate	conf.low	conf.high	adj.p.value
Temp	Room-Fridge	-112.8	-129.75	-95.86	0

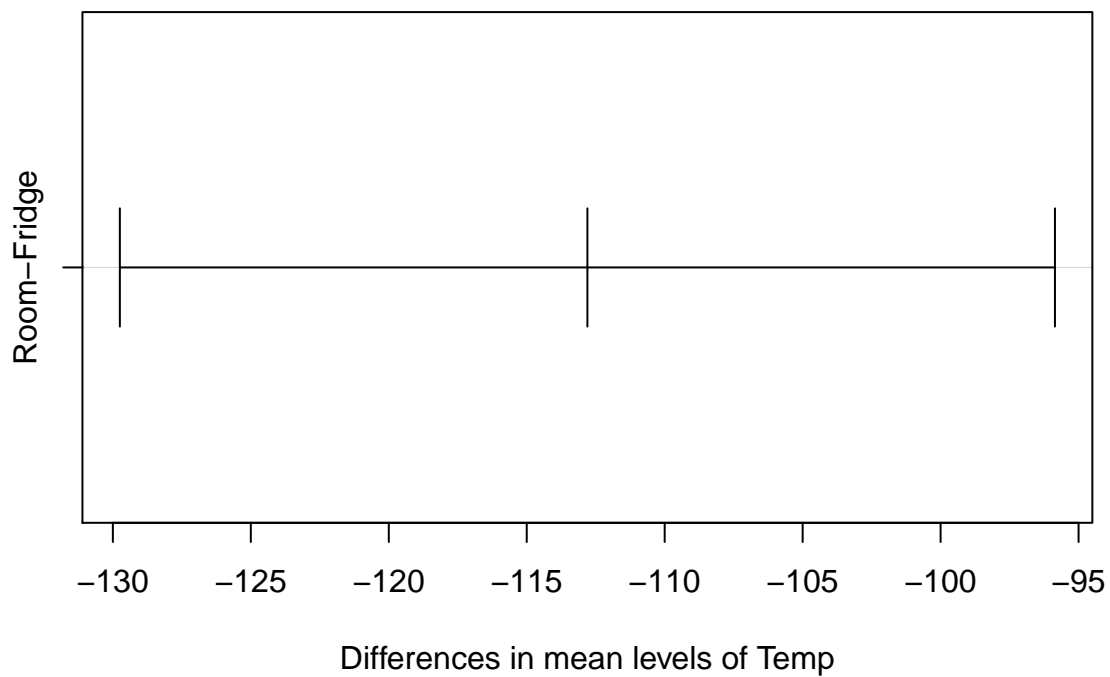
```
TukeyHSD(step_aov, "Liquid", conf.level = 0.95) %>%
  tidy() %>%
  select(-null.value) %>%
  kable(digits = 2)
```

term	contrast	estimate	conf.low	conf.high	adj.p.value
Liquid	Water-Sprite	-27.81	-44.75	-10.86	0

Tukey plots

```
plot(TukeyHSD(step_aov, "Temp", conf.level = 0.95))
```

95% family-wise confidence level



```
plot(TukeyHSD(step_aov, "Liquid", conf.level = 0.95))
```

95% family-wise confidence level

