Statistics Lab

Your Name(s) Here

2/26/2018

Study 1

Read the data

```
# Load data from CSV
study1.data <- read.csv("study1.csv")
# Output typing of each variable
str(study1.data)
```

```
## 'data.frame':    30 obs. of  3 variables:
##  $ Participant: int  1 1 1 2 2 2 3 3 3 4 ...
##  $ Method     : Factor w/ 3 levels "Graffiti","keyboard",..: 1 2 3 1 2 3 1 2 3 1 ...
##  $ WPM        : num  13.2 55.7 143.3 14.2 68.3 ...
```

1.1 What type was each variable assigned to? Are these correct?

YOUR ANSWER HERE

```
# Participant should be categorical, not an integer
study1.data$Participant <- as.factor(study1.data$Participant)
```

Examine WPM

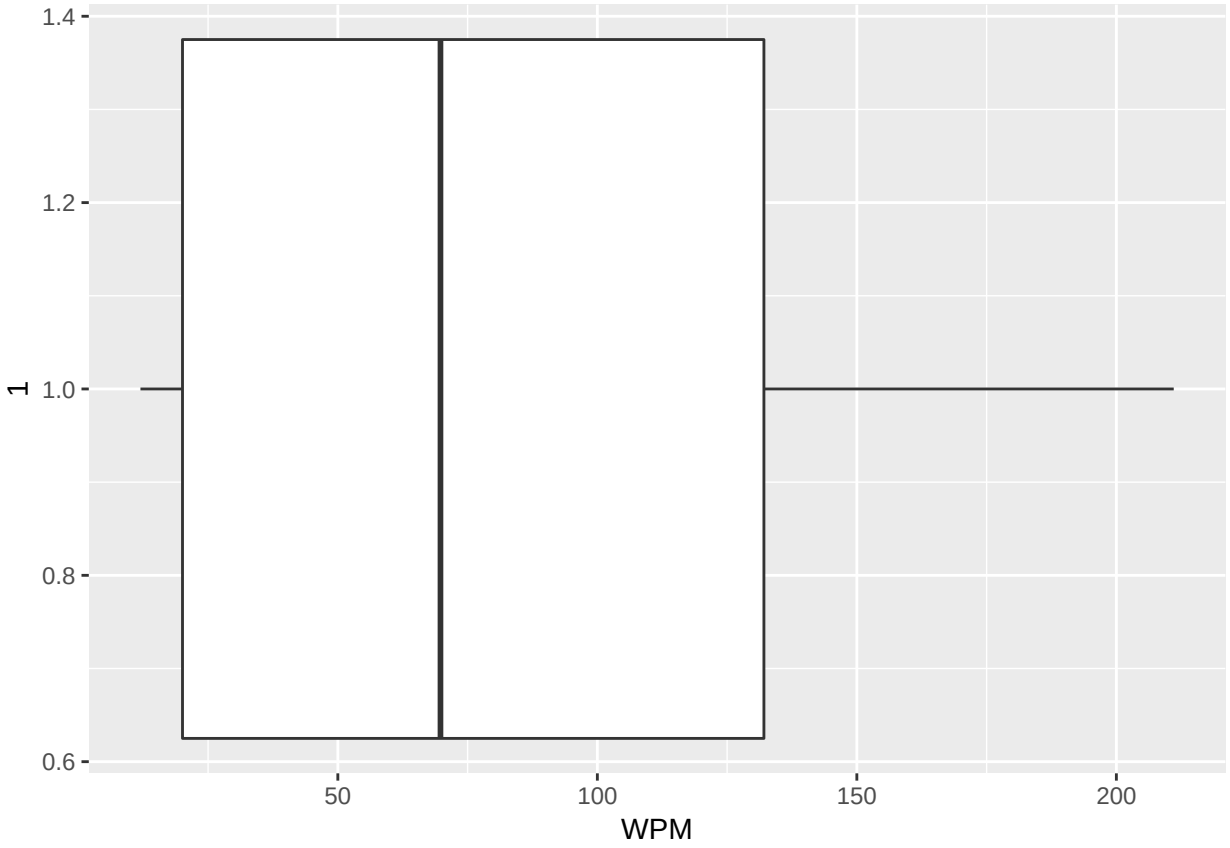
```
summary(study1.data$WPM)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   11.97   20.07   69.78   80.97  132.09  211.05
```

```
describe(study1.data$WPM)
```

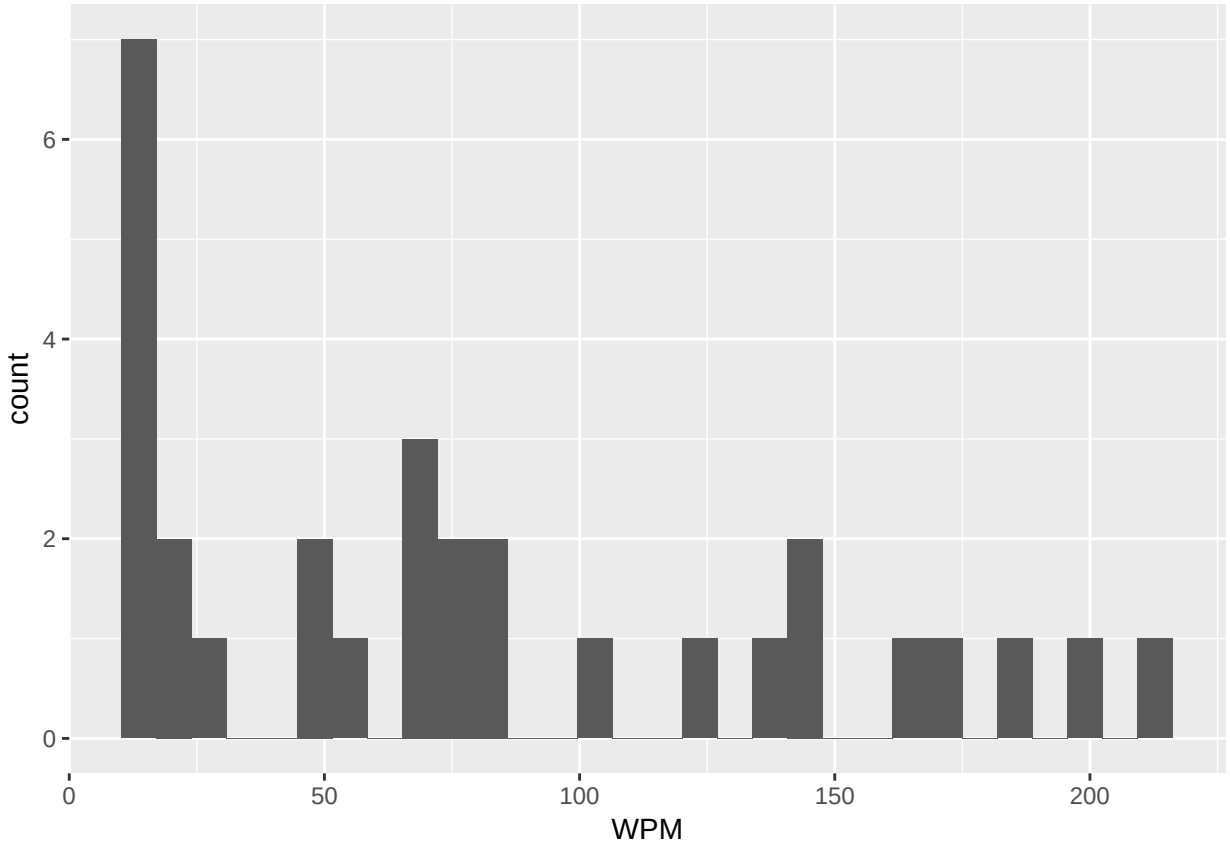
```
##    vars  n  mean   sd median trimmed   mad   min    max  range skew
## X1    1 30 80.97 63.2  69.78    74.8 77.27 11.97 211.05 199.08 0.58
##    kurtosis    se
## X1    -1.01 11.54
```

```
#boxplot expects 2 arguments by default, so we set x to be 1.
qplot(x=1, y=WPM, data=study1.data, geom="boxplot") + coord_flip()
```



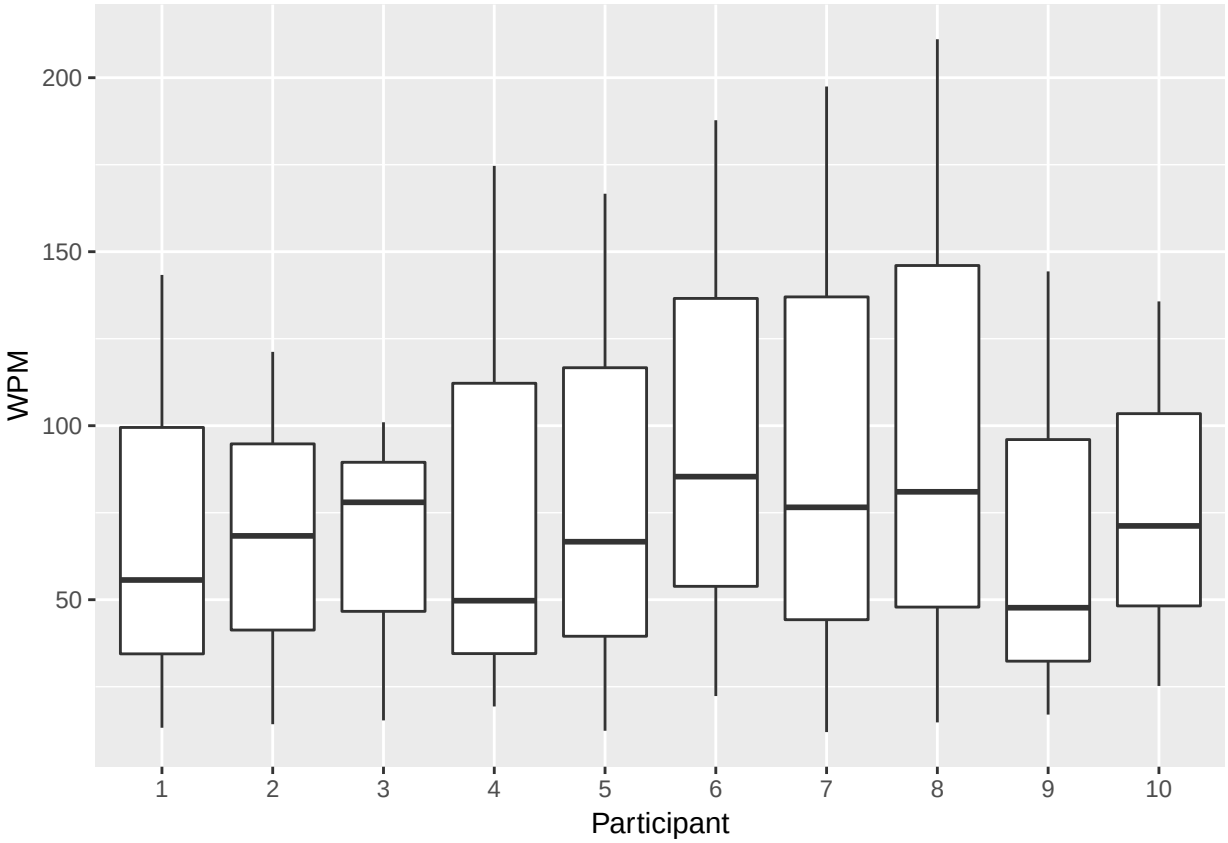

```
# This command would save the previous ggplot image, if you wanted to do so for a paper
# ggsave(file="study1_wpm_boxplot.png")

qplot(WPM, data=study1.data, geom="histogram")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Plot WPM vs Participant

```
qplot(x=Participant, y=WPM, data=study1.data, geom="boxplot")
```



Create and Test a Mixed Model

```
study1.mixedmodel <- lmer(WPM ~ Method + (1 | Participant), data=study1.data)
study1.mixedmodel
```

```
## Linear mixed model fit by REML ['merModLmerTest']
## Formula: WPM ~ Method + (1 | Participant)
##    Data: study1.data
## REML criterion at convergence: 249.8256
## Random effects:
##  Groups      Name        Std.Dev.
##  Participant (Intercept)  6.035
##  Residual                 20.958
## Number of obs: 30, groups:  Participant, 10
## Fixed Effects:
##    (Intercept)  Methodkeyboard    Methodspeech
##          16.57           51.45          141.76
```

```
anova(study1.mixedmodel)
```

```
## Analysis of Variance Table of type III  with  Satterthwaite
## approximation for degrees of freedom
##        Sum Sq Mean Sq NumDF  DenDF F.value    Pr(>F)
## Method 102989   51494     2 18.001  117.24 4.756e-11 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Run a Tukey HSD

```
study1.tukey <- glht(study1.mixedmodel, linfct=mcp(Method = "Tukey"))
summary(study1.tukey)
```

```
##
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: Tukey Contrasts
##
##
## Fit: lme4::lmer(formula = WPM ~ Method + (1 | Participant), data = study1.data)
##
## Linear Hypotheses:
##                            Estimate Std. Error z value Pr(>|z|)
## keyboard - Graffiti == 0   51.455      9.373   5.490 1.07e-07 ***
## speech - Graffiti == 0    141.756      9.373  15.124  < 1e-07 ***
## speech - keyboard == 0     90.301      9.373   9.634  < 1e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

Describe your Analysis

1.2: Complete the folowing paragraph

We performed a mixed model analysis of variance, treating *method* as a fixed effect and *participant* as a random effect. We found a significant main effect of *method* ($F($ _____ , _____ $) =$ _____, $p \approx$ _____), prompting us to investigate pairwise differences. We employed Tukey's HSD procedure to address the increased risk of Type I error due to unplanned comparisons, finding that *speech* leads to significantly greater *WPM* than both *keyboard* ($z =$ _____, $p \approx$ _____) and *Graffiti* ($z =$ _____, $p \approx$ _____) and that *keyboard* also leads to significantly greater *WPM* than *Graffiti* ($z =$ _____, $p \approx$ _____).

Study 2

Read the File

2.1 What type was assigned to each variable? Did you have to change any types?

YOUR CODE/ANSWER HERE

Analyze Time

2.2 Create a mixed-effect model for Time and run an ANOVA

YOUR CODE HERE

2.3 Create a mixed-effect model for Time, using only the significant variables, and run an ANOVA

YOUR CODE HERE

2.4 Create a model including Trial crossed with Interface and run an ANOVA

YOUR CODE HERE

2.5 Does Trial significantly interact with Interface? What does this mean?

YOUR ANSWER HERE

2.6 Complete your analysis of Time.

YOUR CODE HERE

2.7 Prepare a description of your analysis that resembles that in 1.6.

YOUR ANSWER HERE

Analyze Restarts

2.8 Prepare a description of your analysis of Restarts that resembles that in 1.6.

YOUR ANALYSIS HERE

Analyze Correctness

2.9 Prepare a description of your analysis of Correctness that resembles that in 1.6.

YOUR ANALYSIS HERE

Summarize the Results

2.10 Summarize your results

YOUR SUMMARY HERE

Study 3

Analyze the Data

3.1 Analysis

YOUR ANALYSIS HERE

Summarize the Results

3.2 Summary

YOUR SUMMARY HERE