Lab2

As we consider designed experiments, the process should not only focus on how to collect data, but we should also have a data analysis plan before collecting any data. With experiments we can be intentional in the decision phase so that data analysis can be simple.

For this lab, we are going to simulate data from a 1-factor designed experiment.

Experimental Overview Suppose we are interested in the ability of boot gloves to keep the interior of a ski boot warm.

Thirty participants will be selected to participate in this experiment. All participants will be placed in a zegree degree chamber for 30 minutes. A boot glove will be randomly placed on one of the participants ski boots, the other boot will not have a boot glove. Sensors will record the temperature in each boot at the end of the 30 minute session.

Q1 Assume that the boot gloves actually have no effect interior temperature of the boots, simulate data to represent the boot temperatures for the thirty participants.

```
set.seed(01242022)
num_participants <- 30
participant_sd <- 10
participant_temps <- rnorm(num_participants, mean = 50, sd = participant_sd)
boot_sd <- 2
boot_temps <- rnorm(num_participants * 2, mean = rep(participant_temps, each = 2), sd = boot_sd)
boot_data <- tibble(temp = boot_temps,
                    subject = factor(rep(1:num_participants, each =2)),
                    treatment = rep(c('Glove','No Glove'), num_participants))
```

Q2 Create a side-by-side visual of the data. This should include notation for both the treatment and subjects.

```
boot_data %>%
  ggplot(aes(y = boot_temps, x = treatment, label = subject)) +
  geom_violinhalf() +
  geom_boxplot(width=0.1) +
  geom_text(position = position_jitter(seed = 1)) +
  theme_bw() +
  ylab('Boot Temperature') +
  xlab('') +
  ggtitle('Boot temperature as a function of boot glove presence.')
```

Q3 Now repeat Q1 and Q2 where there is a 5 degree effect from the boot glove.

```
num_participants <- 10
participant_sd <- 10
participant_temps <- rnorm(num_participants, mean = 50, sd = participant_sd)
boot_sd <- 2
boot_mean <- rep(participant_temps, each = 2) + rep(c(0,5), num_participants)
boot_temps <- rnorm(num_participants * 2, mean = boot_mean, sd = boot_sd)
```

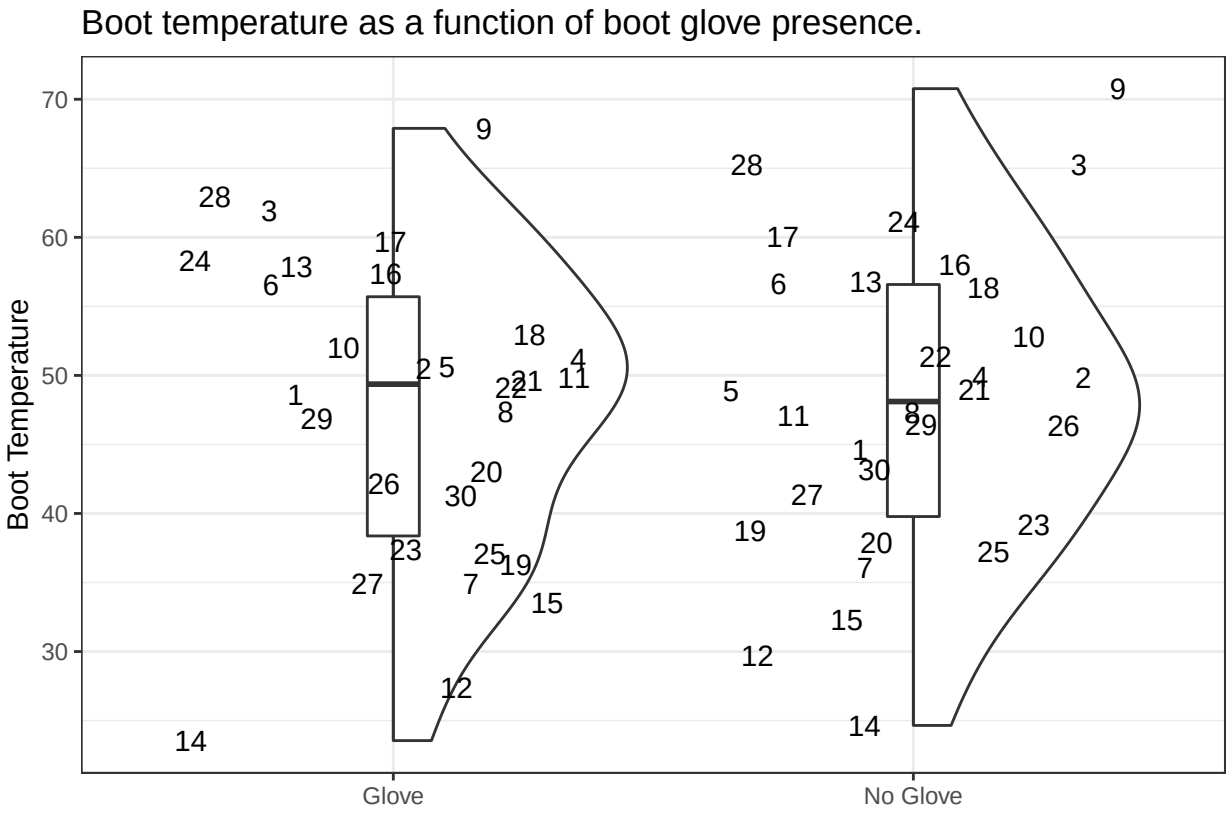

Figure 1: Final temperatures are shown for each subject depending on whether a boot glove is worn for the experiment. The numbers indicate subject number for each observation. We see minimal impacts from wearing the boot glove.

```r
boot_data2 <- tibble(temp = boot_temps,
                     subject = factor(rep(1:num_participants, each =2)),
                     treatment = rep(c('Glove','No Glove'), num_participants))
```

```r
boot_data2 %>%
  ggplot(aes(y = boot_temps, x = treatment, label = subject)) +
  geom_violinhalf() +
  geom_boxplot(width=0.1) +
  geom_text(position = position_jitter(seed = 1)) +
  theme_bw() +
  ylab('Boot Temperature') +
  xlab('') +
  ggtitle('Boot temperature as a function of boot glove presence.')
```

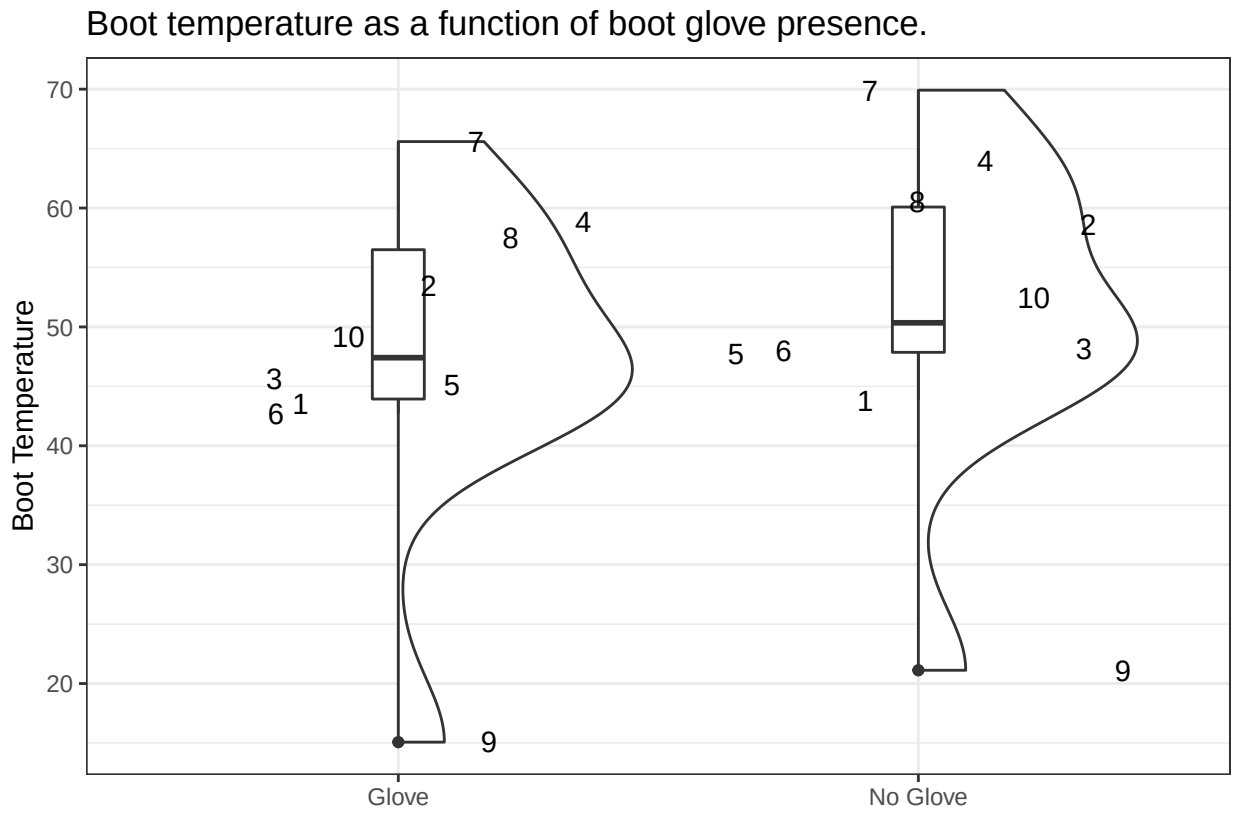

Figure 2: Final temperatures are shown for each subject depending on whether a boot glove is worn for the experiment. The numbers indicate subject number for each observation. It appears that there may be a difference in the temperature, but more data may be required to verify.