Analysis Report: Exploring Daily Activity Patterns

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Objective: This analysis aims to explore daily activity patterns based on data collected from a personal activity monitoring device. The data spans two months, from October to November 2012, and records the number of steps taken at 5-minute intervals throughout each day.

```
### Code for reading in the dataset and/or processing the data
# Load necessary libraries
# The analysis starts by loading the dataset and preprocessing it.
# Missing values are imputed, and the percentage of missing data is calculated.
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 4.2.3
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 4.2.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(lattice)
library(hexbin)
```

```
## Warning: package 'hexbin' was built under R version 4.2.3
```

```
# Read in the dataset and preprocess the data

activity <- read.csv("activity.csv")
activity$date <- as.Date(activity$date, format = "%Y-%m-%d")
# Check the dimensions and structure of the dataset
dim(activity)
```

```
## [1] 17568     3
```

```
names(activity)
```

```
## [1] "steps"    "date"     "interval"
```

```
head(activity)
```

```
##   steps       date interval
## 1    NA 2012-10-01        0
## 2    NA 2012-10-01        5
## 3    NA 2012-10-01       10
## 4    NA 2012-10-01       15
## 5    NA 2012-10-01       20
## 6    NA 2012-10-01       25
```

```
str(activity)
```

```
## 'data.frame':    17568 obs. of  3 variables:
##  $ steps   : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ date    : Date, format: "2012-10-01" "2012-10-01" ...
##  $ interval: int  0 5 10 15 20 25 30 35 40 45 ...
```

```
# Impute missing values
missing_values <- sum(is.na(activity$steps))
total_records <- dim(activity)[1]
missing_percentage <- missing_values / total_records


###What is mean total number of steps taken per day?
# To understand daily activity patterns, the mean total number of steps taken per day is calculated.
# The analysis reveals that on average, steps are taken per day.
# The resulting bar plot visualizes the total steps taken each day.

sum(is.na(activity$steps))/dim(activity)[[1]]
```

```
## [1] 0.1311475
```

```
library(lubridate)
activity$date <- ymd(activity$date)
length(unique(activity$date))
```

```
## [1] 61
```

```
library(ggplot2)

## What is the average daily activity pattern?
# Calculate the mean total number of steps taken per day
AM <- data.frame(tapply(activity$steps, activity$date, sum, na.rm = TRUE))
AM$date <- rownames(AM)
rownames(AM) <- NULL
names(AM)[[1]] <- "Total Steps"
# Create a bar plot to visualize the total steps by date
png("plot1.png")
ggplot(AM, aes(y = AM$`Total Steps`, x = AM$date)) + geom_bar(stat = "identity") + ylab("Total Steps") +
```

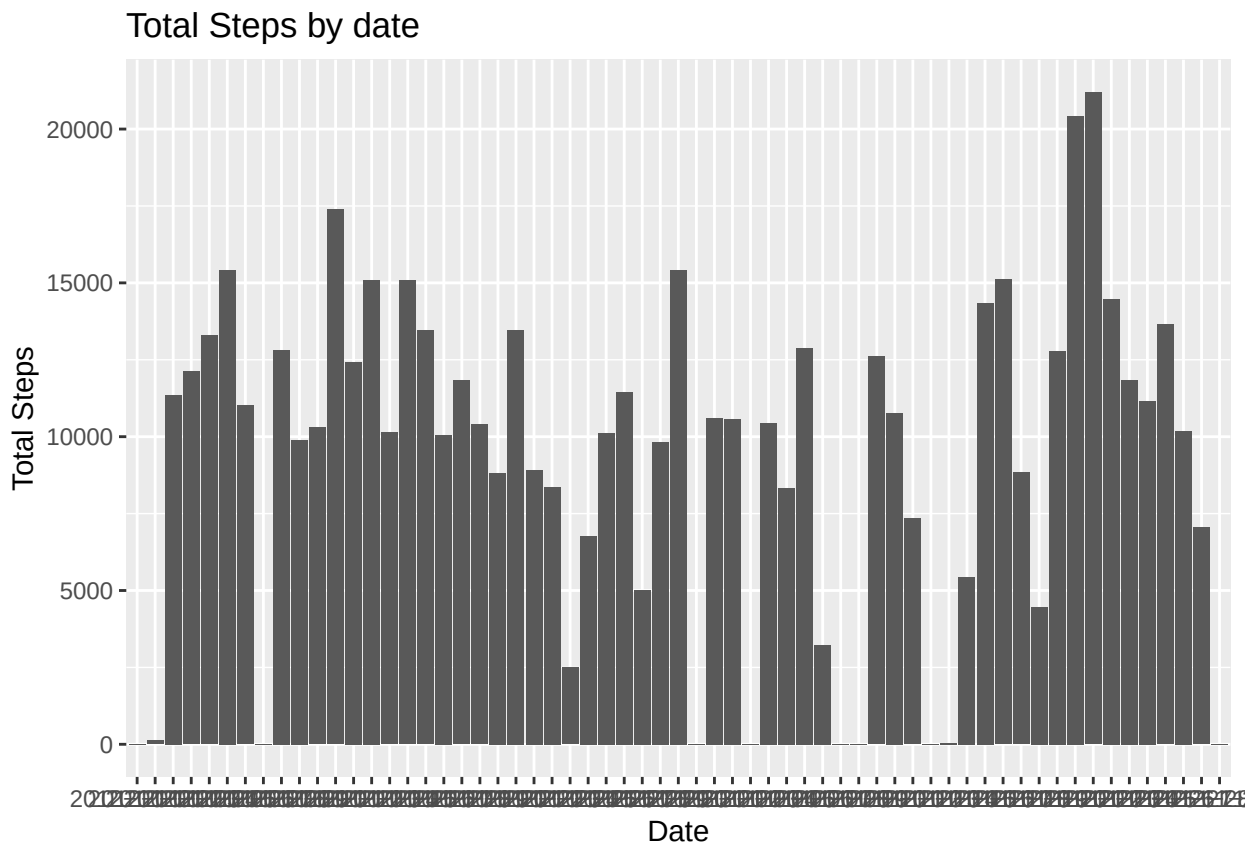
```
## Warning: Use of ‘AM$date‘ is discouraged.
## i Use ‘date‘ instead.

## Warning: Use of ‘‘ AM$‘Total Steps‘ ‘‘ is discouraged.
## i Use ‘Total Steps‘ instead.
```

```
dev.off()
```

```
## pdf
##   2
```

```
ggplot(AM, aes(y = AM$`Total Steps`, x = AM$date)) + geom_bar(stat = "identity") + ylab("Total Steps") +
```

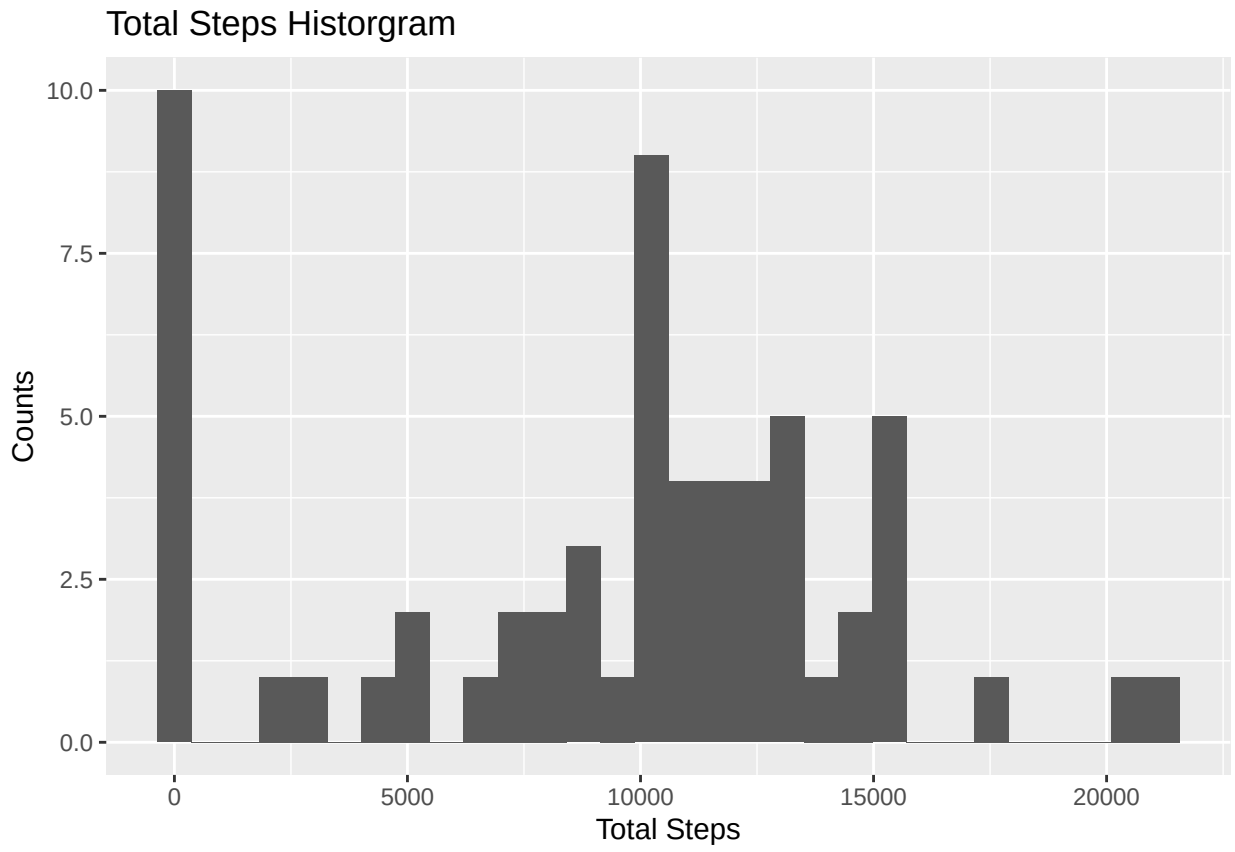
```
## Warning: Use of ‘AM$date‘ is discouraged.
## i Use ‘date‘ instead.
## Use of ‘‘ AM$‘Total Steps‘ ‘‘ is discouraged.
## i Use ‘Total Steps‘ instead.
```




```
# To understand the distribution of daily steps, a histogram is created.


qplot(AM$`Total Steps`, geom = "histogram", xlab = "Total Steps", ylab = "Counts", main = "Total Steps
```

```
## Warning: ‘qplot()‘ was deprecated in ggplot2 3.4.0.
## This warning is displayed once every 8 hours.
## Call ‘lifecycle::last_lifecycle_warnings()‘ to see where this warning was
## generated.
```

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




```
png("plot2.png")
qplot(AM$`Total Steps`, geom = "histogram", xlab = "Total Steps", ylab = "Counts", main = "Total Steps
```

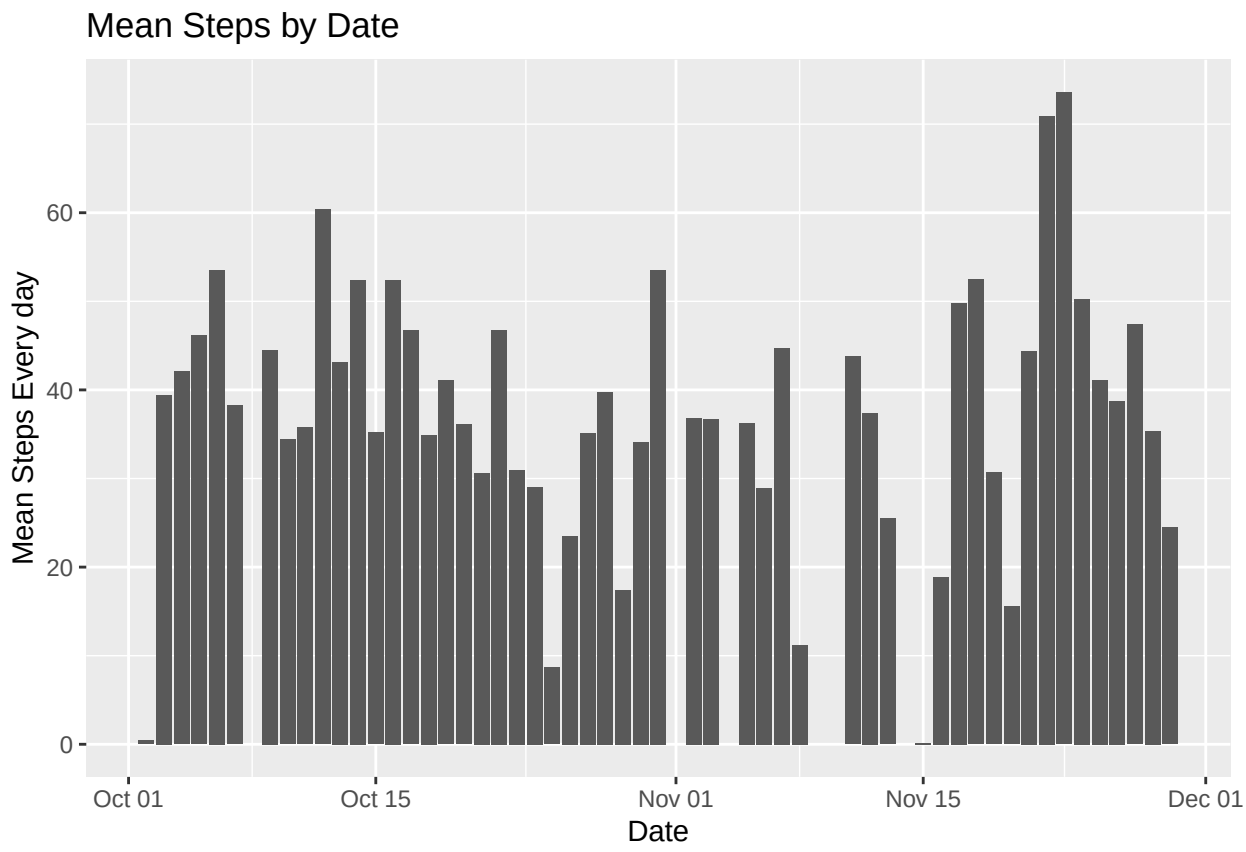
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
dev.off()
```

```
## pdf
##   2
```

```
# Calculate and report the mean and median total number of steps taken per day
library(dplyr)
AM2 <- data.frame(round(tapply(activity$steps, activity$date, mean, na.rm = TRUE), 2))
AM2$date <- rownames(AM2)
rownames(AM2) <- NULL
names(AM2)[[1]] <- "Mean Steps"
# Calculate the median steps per day
temp <- activity %>% select(date, steps) %>% group_by(date) %>% summarise(median(steps))
names(temp)[[2]] <- "Median Steps"
# Create a bar plot to visualize mean steps by date
AM2$median <- temp$`Median Steps`
AM2 <- AM2 %>% select(date, `Mean Steps`, median)
AM3 <- AM2
AM3$date <- as.Date(AM3$date, format = "%Y-%m-%d")
ggplot(AM3, aes(x = AM3$date, y = AM3$`Mean Steps`)) + geom_bar(stat = "identity") + scale_x_date() + y
```

```
## Warning: Use of ‘AM3$date‘ is discouraged.
## i Use ‘date‘ instead.

## Warning: Use of ‘‘ AM3$‘Mean Steps‘ ‘‘ is discouraged.
## i Use ‘Mean Steps‘ instead.

## Warning: Removed 8 rows containing missing values (‘position_stack()‘).
```



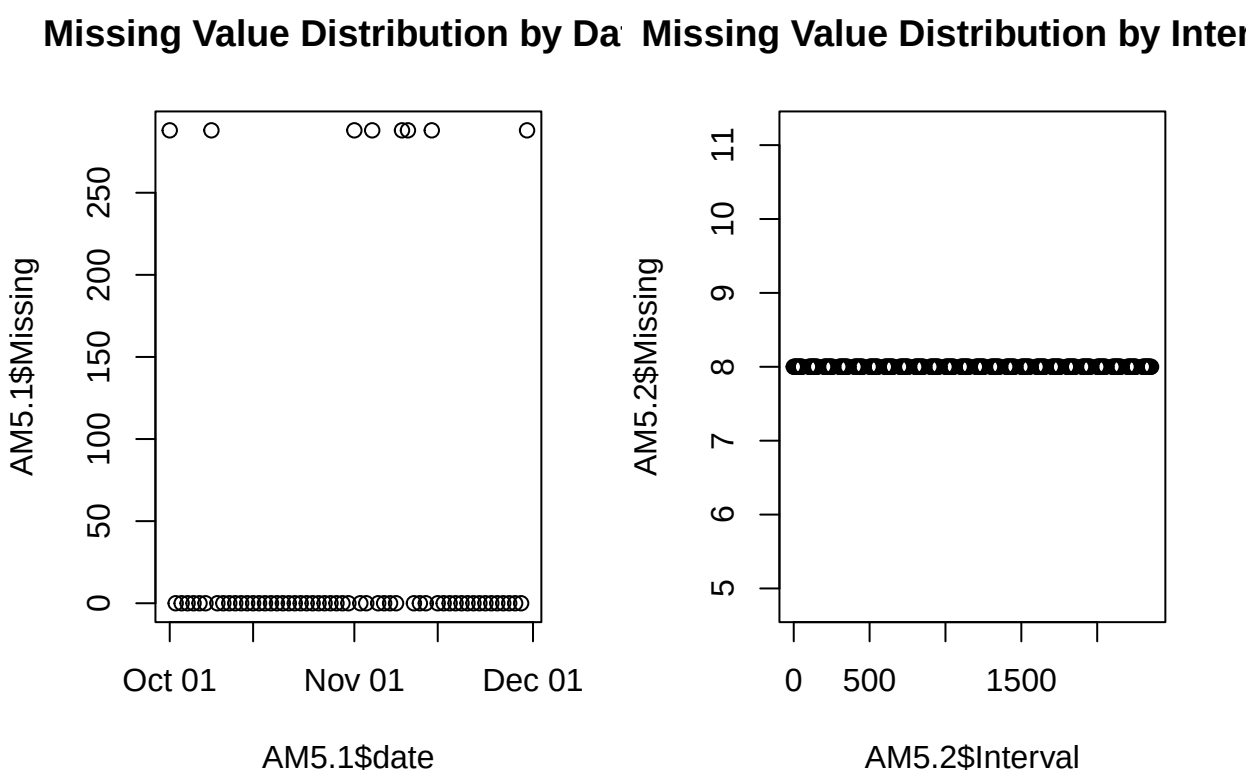

```
png("plot3.png")
ggplot(AM3, aes(x = AM3$date, y = AM3$`Mean Steps`)) + geom_bar(stat = "identity") + scale_x_date() + yl
```

```
## Warning: Use of ‘AM3$date‘ is discouraged.
## i Use ‘date‘ instead.

## Warning: Use of ‘‘ AM3$‘Mean Steps‘ ‘‘ is discouraged.
## i Use ‘Mean Steps‘ instead.

## Warning: Removed 8 rows containing missing values (‘position_stack()‘).
```

```
dev.off()
```

```
## pdf
##   2
```

```r
activity$interval <- factor(activity$interval)
# Analyze activity patterns by interval
# Activity Patterns by Interval:

# The analysis explores activity patterns based on intervals.
# The bar plot "Mean Steps by Date" shows how mean steps vary over the observed period.
# A hexbin plot provides an alternative visualization of activity patterns across intervals.
AM4 <- aggregate(data = activity, steps ~ date + interval, FUN = "mean")
AM4 <- aggregate(data = AM4, steps ~ interval, FUN = "max")
# Analyze missing data patterns
AM5 <- activity
AM5$Missing <- is.na(AM5$steps)
AM5 <- aggregate(data = AM5, Missing ~ date + interval, FUN = "sum")
# Create plots to visualize missing value distribution
# Missing Data Patterns:

# The analysis investigates patterns of missing data.
# Two plots are created to visualize missing data distribution by date and by interval.

AM5.1 <- data.frame(tapply(AM5$Missing, AM5$date, sum))
AM5.1$date <- rownames(AM5.1)
rownames(AM5.1) <- NULL
names(AM5.1) <- c("Missing", "date")
AM5.1$date <- as.Date(AM5.1$date, format = "%Y-%m-%d")

AM5.2 <- data.frame(tapply(AM5$Missing, AM5$interval, sum))
AM5.2$date <- rownames(AM5.2)
rownames(AM5.2) <- NULL
names(AM5.2) <- c("Missing", "Interval")

par(mfrow = c(1, 2))
plot(y = AM5.1$Missing, x = AM5.1$date, main = "Missing Value Distribution by Date")
plot(y = AM5.2$Missing, x = AM5.2$Interval, main = "Missing Value Distribution by Interval")
```




```
table(activity$date)
```

```
##
## 2012-10-01 2012-10-02 2012-10-03 2012-10-04 2012-10-05 2012-10-06 2012-10-07
##        288        288        288        288        288        288        288
## 2012-10-08 2012-10-09 2012-10-10 2012-10-11 2012-10-12 2012-10-13 2012-10-14
##        288        288        288        288        288        288        288
## 2012-10-15 2012-10-16 2012-10-17 2012-10-18 2012-10-19 2012-10-20 2012-10-21
##        288        288        288        288        288        288        288
## 2012-10-22 2012-10-23 2012-10-24 2012-10-25 2012-10-26 2012-10-27 2012-10-28
##        288        288        288        288        288        288        288
## 2012-10-29 2012-10-30 2012-10-31 2012-11-01 2012-11-02 2012-11-03 2012-11-04
##        288        288        288        288        288        288        288
## 2012-11-05 2012-11-06 2012-11-07 2012-11-08 2012-11-09 2012-11-10 2012-11-11
##        288        288        288        288        288        288        288
## 2012-11-12 2012-11-13 2012-11-14 2012-11-15 2012-11-16 2012-11-17 2012-11-18
##        288        288        288        288        288        288        288
## 2012-11-19 2012-11-20 2012-11-21 2012-11-22 2012-11-23 2012-11-24 2012-11-25
##        288        288        288        288        288        288        288
## 2012-11-26 2012-11-27 2012-11-28 2012-11-29 2012-11-30
##        288        288        288        288        288
```

```
library(lubridate)
AM5.3 <- as.data.frame(AM5.1) %>% select(date, Missing) %>% arrange(desc(Missing))
AM5.3 <- AM5.3[which(AM5.3$Missing != 0),]
```

```r
AM5.3$Weekday <- wday(AM5.3$date, label = TRUE)
AM5.4 <- activity
AM5.4$weekday <- wday(AM5.4$date, label = TRUE)
# What is mean total number of steps taken per day?
AM5.5 <- aggregate(data = AM5.4, steps ~ interval + weekday, FUN = "mean", na.rm = TRUE)
# Create a histogram of total steps taken post-imputation
AM5.6 <- merge(x = AM5.4, y = AM5.5, by.x = c("interval", "weekday"), by.y = c("interval", "weekday"), a
AM5.6$Steps.Updated <- 0
for (i in 1:dim(AM5.6)[[1]]) {
  if (is.na(AM5.6[i, 3])) {
    AM5.6[i, 6] = AM5.6[i, 5]
  } else {
    AM5.6[i, 6] = AM5.6[i, 3]
  }
}

# Are there differences in activity patterns between weekdays and weekends??
# The analysis explores whether there are differences in activity patterns between weekdays and weekend
# A histogram of total steps taken post-imputation is created.
# The panel plot "Mean steps across intervals by Weekend and Weekday" provides insights into activity p

AM5.6 <- AM5.6 %>% select(date, weekday, interval, Steps.Updated)
names(AM5.6)[[4]] <- "Steps"
png("plot4.png")
qplot(AM5.6$Steps, geom = "histogram", main = "Total steps taken histogram post imputation", xlab = "St
```

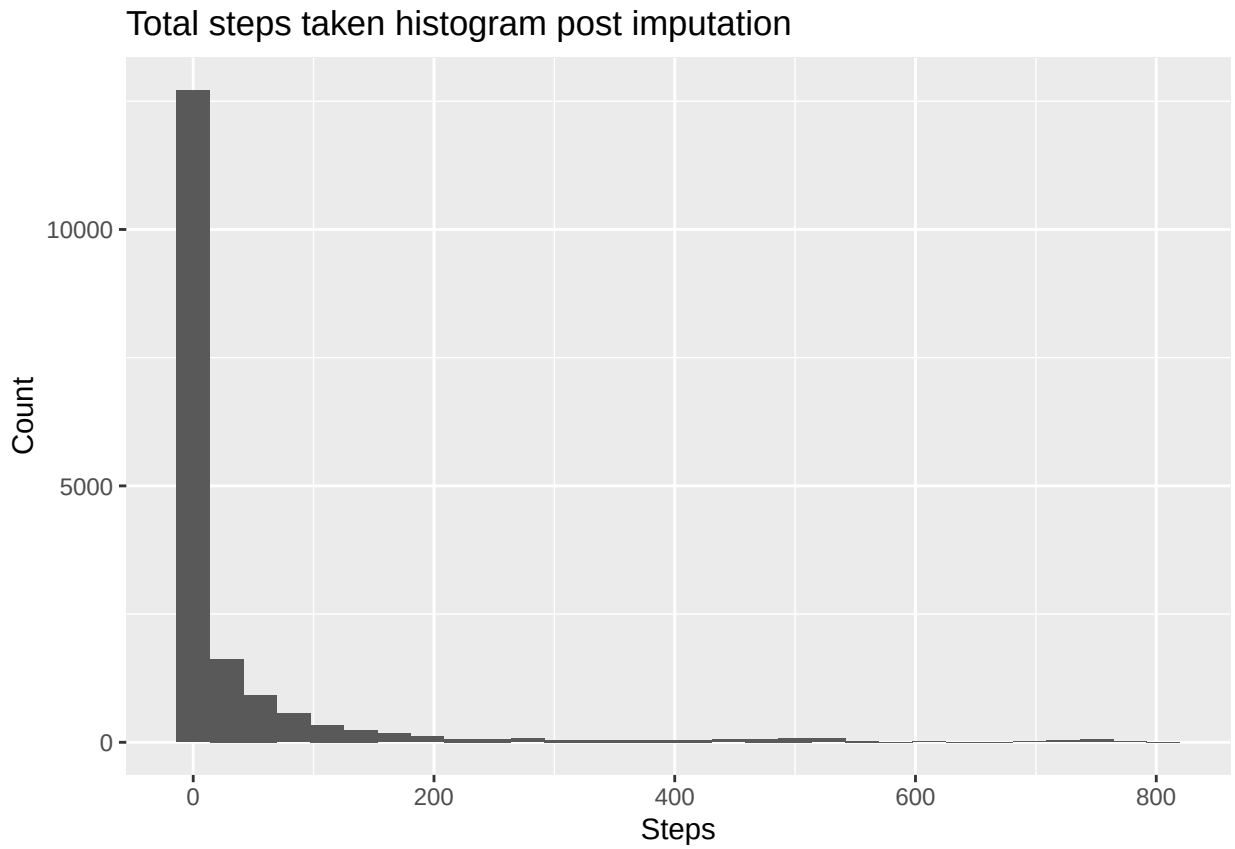
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```r
dev.off()
```

```
## pdf
##   2
```

```r
qplot(AM5.6$Steps, geom = "histogram", main = "Total steps taken histogram post imputation", xlab = "St
```

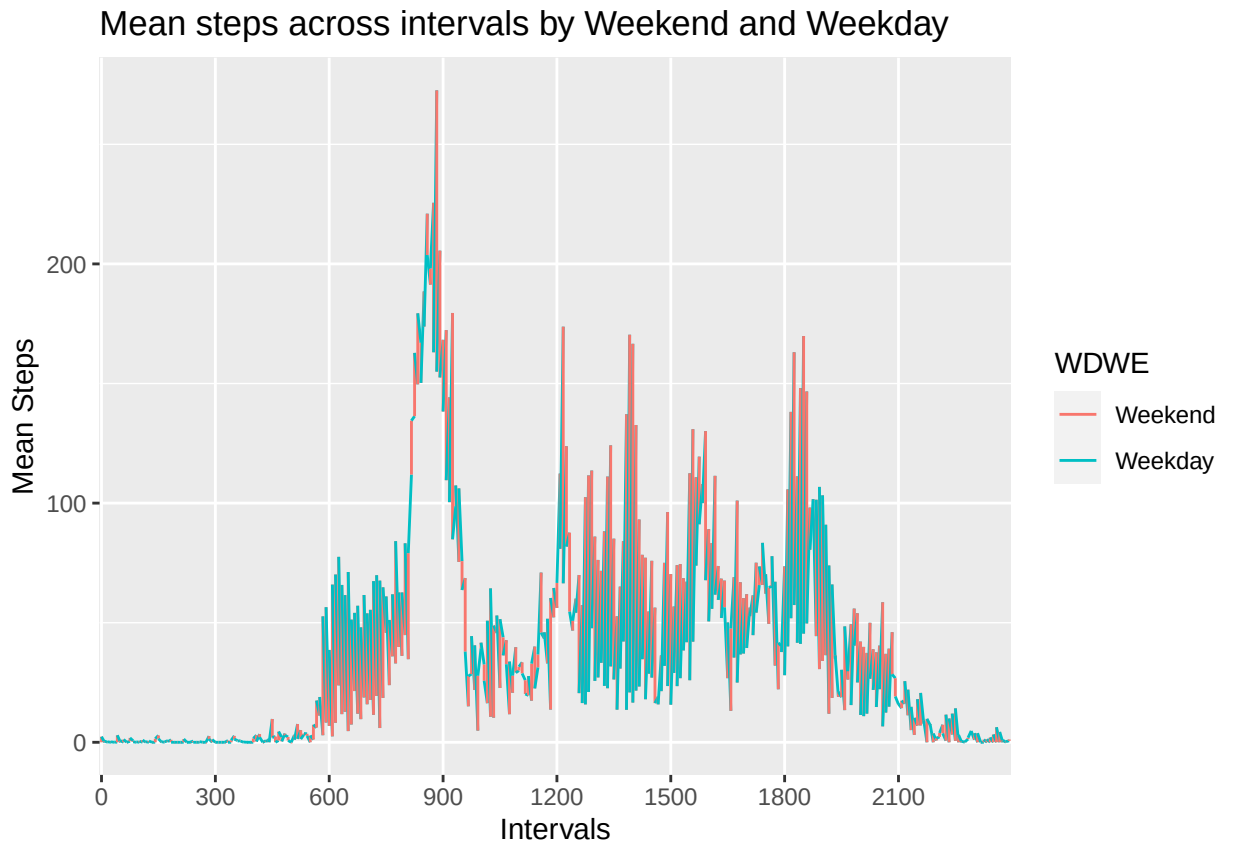
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```




```
AM6 <- AM5.6
levels(AM6$weekday) <- c(1, 2, 3, 4, 5, 6, 7)
AM6$WDWE <- AM6$weekday %in% c(1, 2, 3, 4, 5)
# Create a panel plot containing a time series plot
AM6.1 <- aggregate(data = AM6, Steps ~ interval + WDWE, mean, na.rm = TRUE)
AM6.1$WDWE <- as.factor(AM6.1$WDWE)
levels(AM6.1$WDWE) <- c("Weekend", "Weekday")
# Create a plot to visualize mean steps across intervals by weekend and weekday
png("plot5.png")
ggplot(data = AM6.1, aes(y = Steps, x = interval, group = 1, color = WDWE)) + geom_line() + scale_x_dis
dev.off()
```

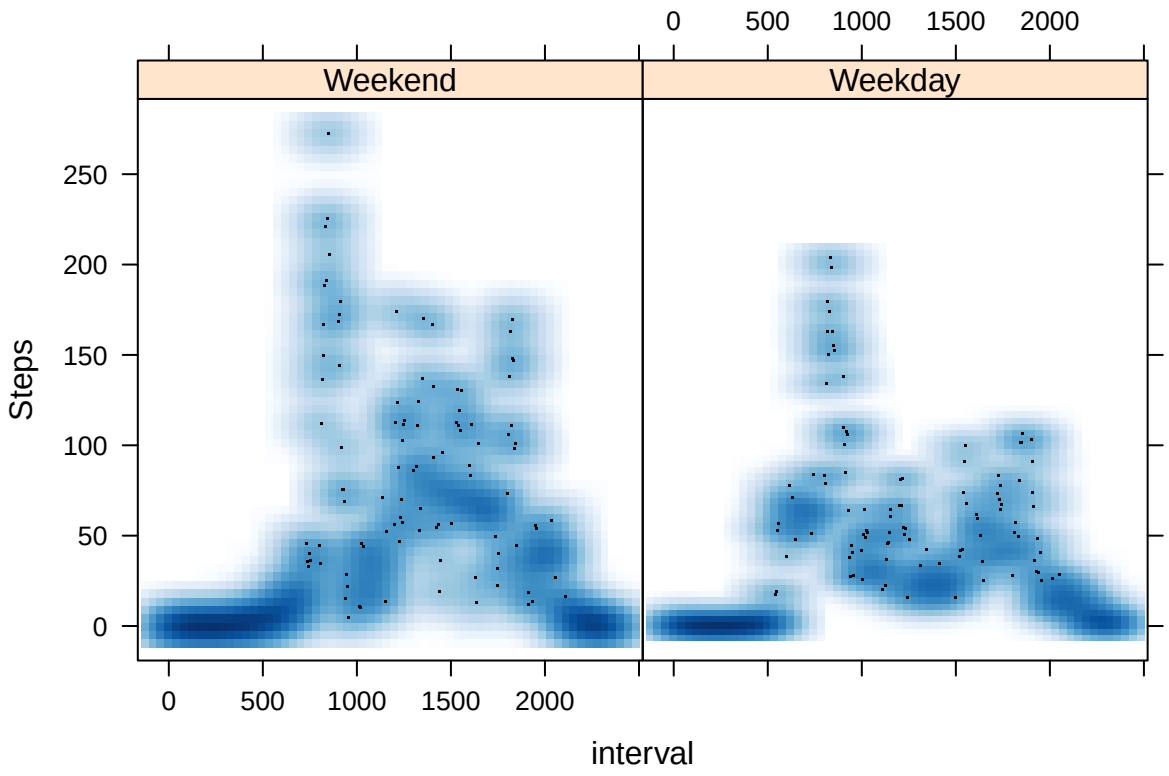
```
## pdf
##   2
```

```
ggplot(data = AM6.1, aes(y = Steps, x = interval, group = 1, color = WDWE)) + geom_line() + scale_x_dis
```

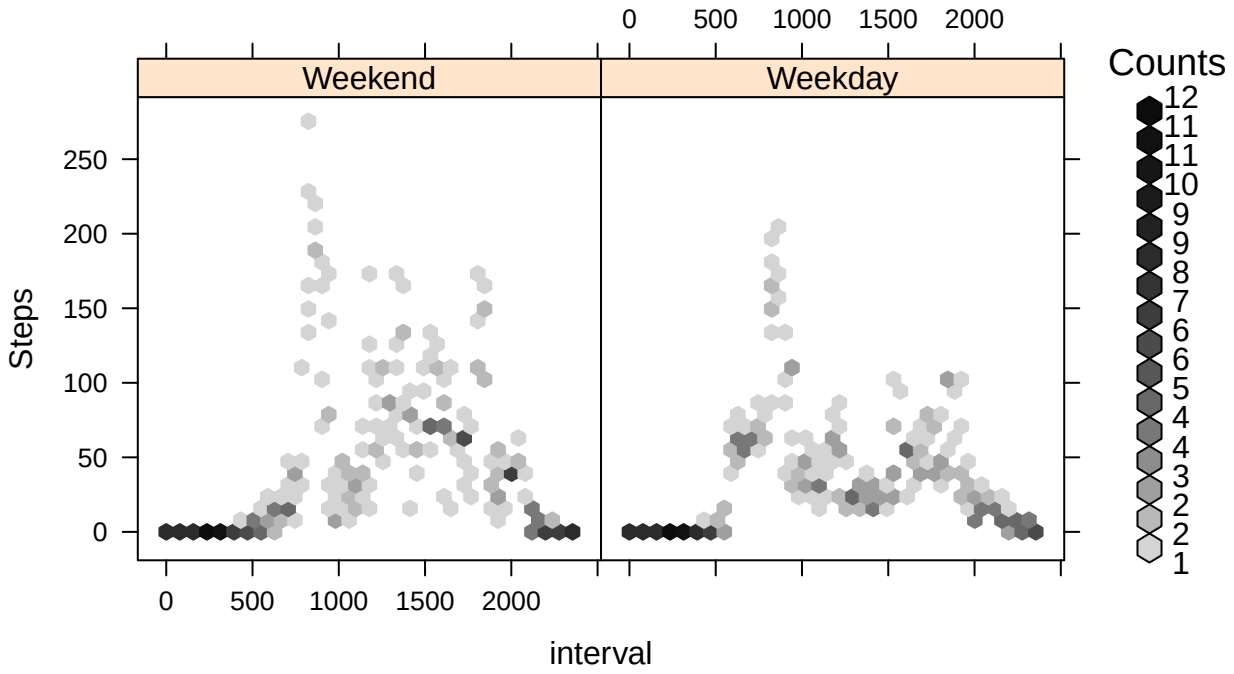



```
# Make a panel plot containing a time series plot

AM6.1$interval <- as.numeric(as.character(AM6.1$interval))
library(lattice)
xyplot(data = AM6.1, Steps ~ interval | WDWE, grid = TRUE, type = c("p", "smooth"), lwd = 4, panel = pa
```

```
## (loaded the KernSmooth namespace)
```




```
library(hexbin)
hexbinplot(data = AM6.1, Steps ~ interval | WDWE, aspect = 1, bins = 50)
```




```
png("plot6.png")
xyplot(data = AM6.1, Steps ~ interval | WDWE, grid = TRUE, type = c("p", "smooth"), lwd = 4, panel = pa
dev.off()
```

```
## pdf
##   2
```

```
# Create hexbin plots for steps across intervals by weekend and weekday
png("plot7.png")
hexbinplot(data = AM6.1, Steps ~ interval | WDWE, aspect = 1, bins = 50)
dev.off()
```

```
## pdf
##   2
```

```
#  Summary:
#  This analysis provides insights into daily activity patterns, missing data distribution, and differe
```