Homework1.Rmd

2024-10-10

Packages and Data Setup

Task 1 - Data Frame

```
# Load the mpg dataset as a Data Frame
df <- as.data.frame(mpg)

# Check the Data Frame
head(df)
```

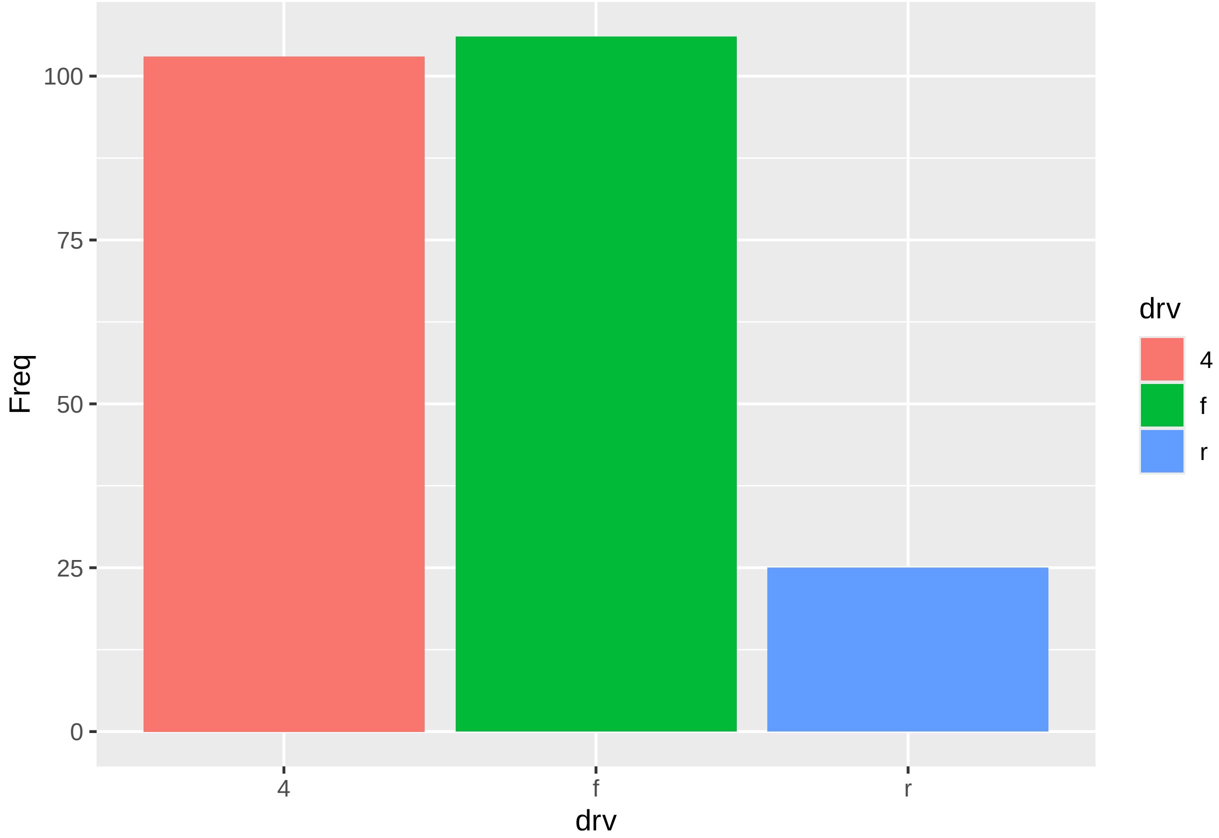
```
##   manufacturer model displ year cyl      trans drv cty hwy fl   class
## 1         audi    a4   1.8 1999   4   auto(l5)   f  18  29  p compact
## 2         audi    a4   1.8 1999   4 manual(m5)   f  21  29  p compact
## 3         audi    a4   2.0 2008   4 manual(m6)   f  20  31  p compact
## 4         audi    a4   2.0 2008   4   auto(av)   f  21  30  p compact
## 5         audi    a4   2.8 1999   6   auto(l5)   f  16  26  p compact
## 6         audi    a4   2.8 1999   6 manual(m5)   f  18  26  p compact
```

```
# Create a frequency table for the 'drv' variable
freq_table <- as.data.frame(table(mpg$drv))

# Calculate relative frequency and percentage
freq_table$rel_Freq <- round(freq_table$Freq / sum(freq_table$Freq), 2)
freq_table$Percentage <- round(freq_table$rel_Freq * 100, 2)

# Rename the columns for clarity
colnames(freq_table) <- c("drv", "Freq", "rel_Freq", "Percentage")

# Print the frequency table
print(freq_table)
```

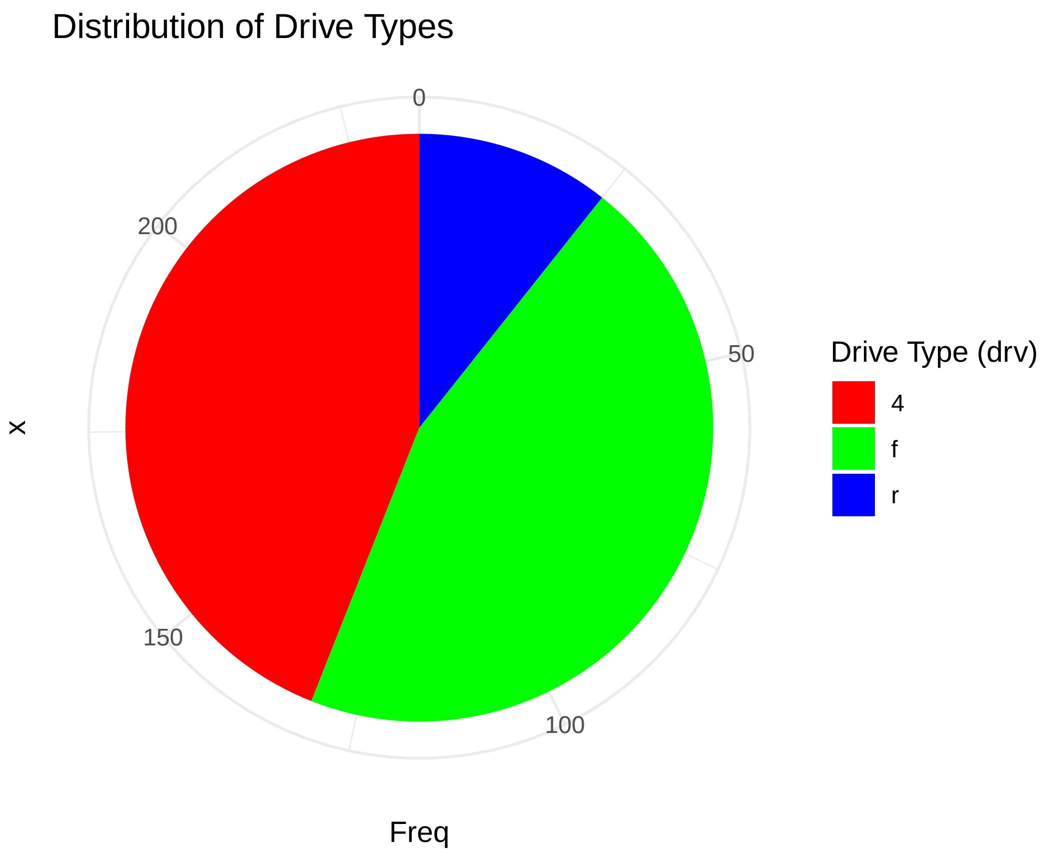
```
##   drv Freq rel_Freq Percentage
## 1   4  103     0.44         44
## 2   f  106     0.45         45
## 3   r   25     0.11         11
```

Visualizations

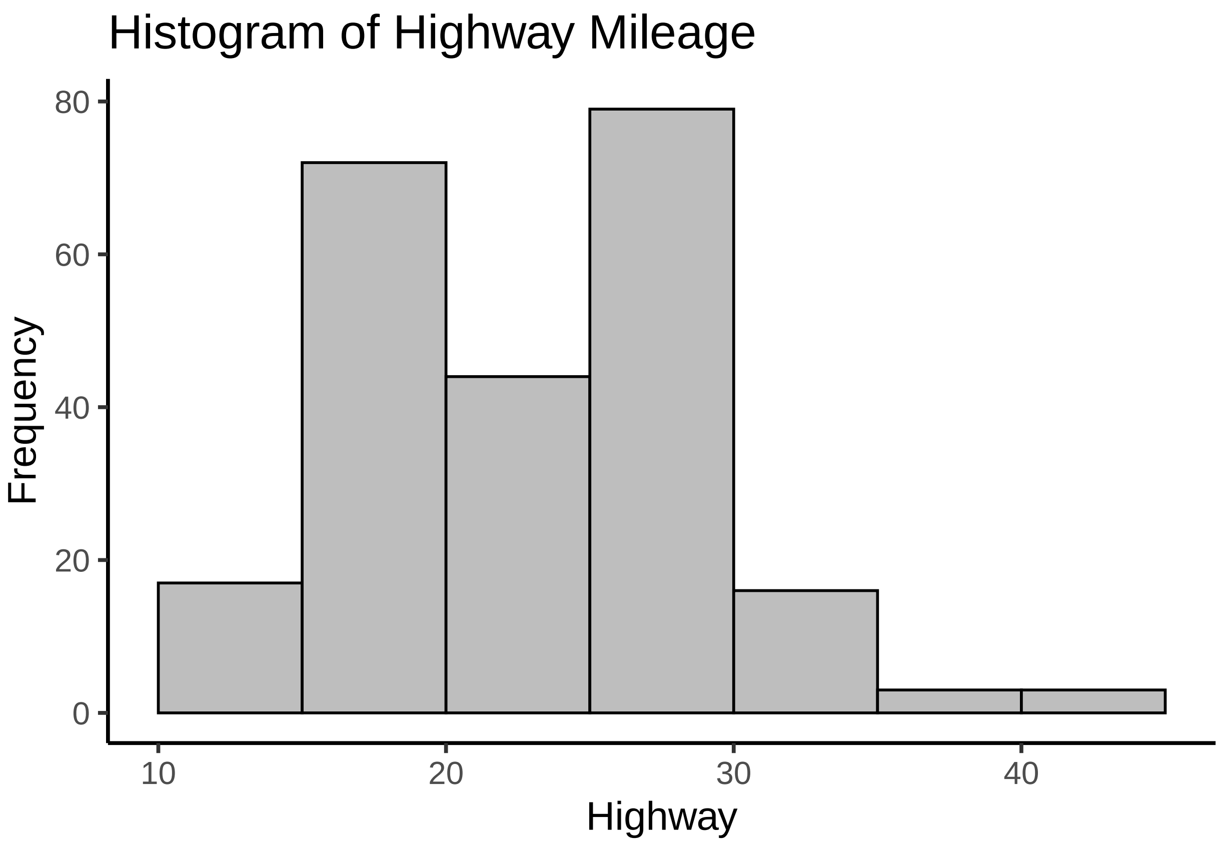
```r
# Create a bar chart
ggplot(freq_table, aes(x = drv, y = Freq, fill = drv)) +
  geom_bar(stat = "identity")
```



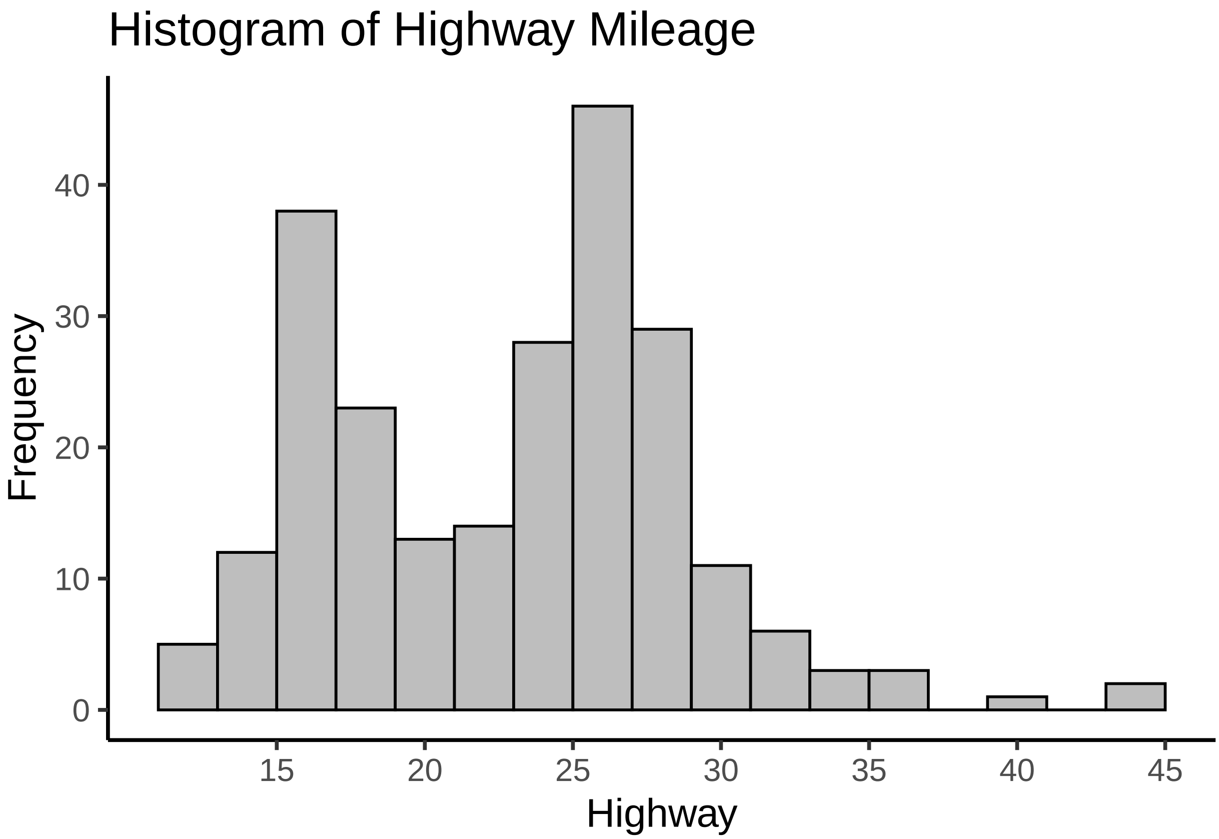
```r
# Create a pie chart
ggplot(freq_table, aes(x = "", y = Freq, fill = drv)) +
  geom_bar(stat = "identity", width = 1) +
  coord_polar(theta = "y") +
  scale_fill_manual(values = c("4" = "red", "f" = "green", "r" = "blue")) +
  labs(title = "Distribution of Drive Types", fill = "Drive Type (drv)") +
  theme_minimal()
```



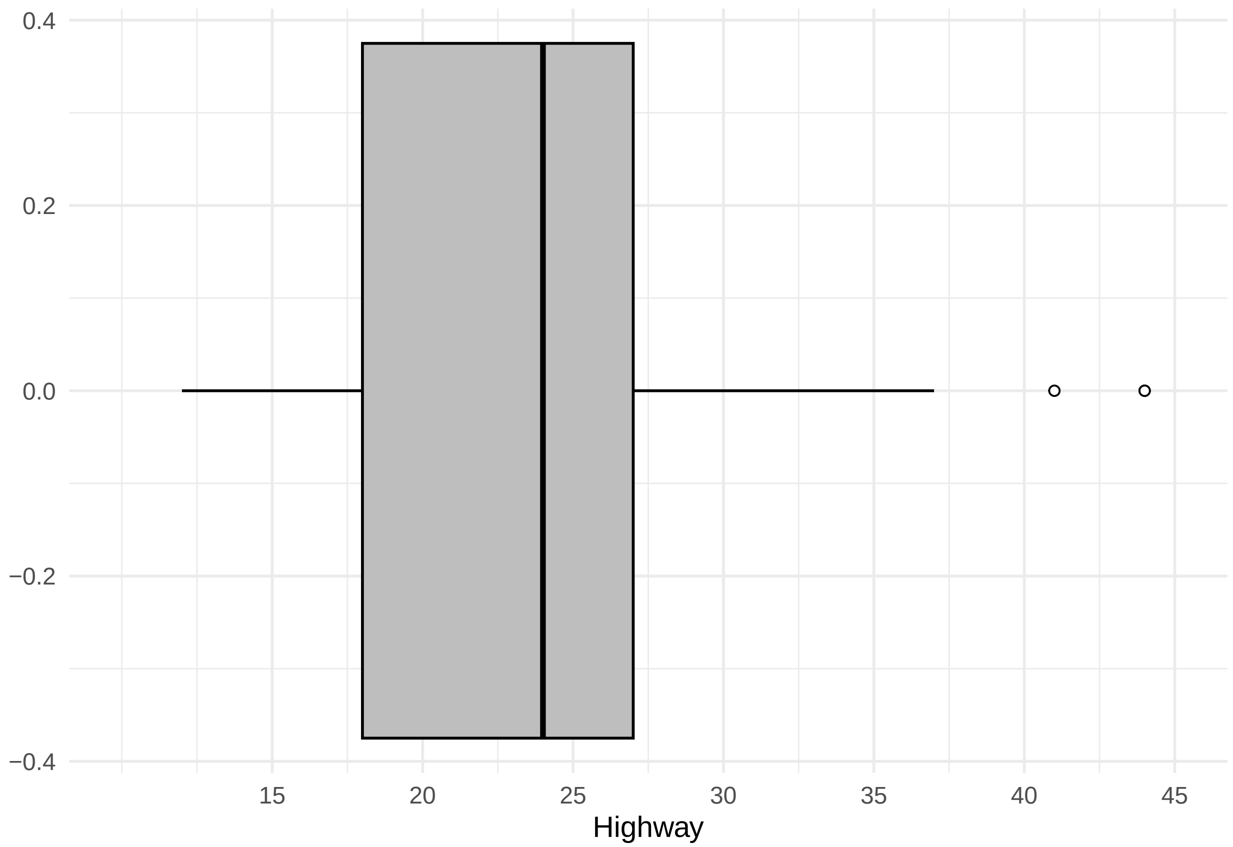
```r
# Simple histogram with custom breaks
ggplot(df, aes(x = hwy)) +
  geom_histogram(breaks = c(10, 15, 20, 25, 30, 35, 40, 45), fill = "grey", color = "black") +
  labs(title = "Histogram of Highway Mileage", x = "Highway", y = "Frequency") +
  theme_classic(base_size = 15)
```



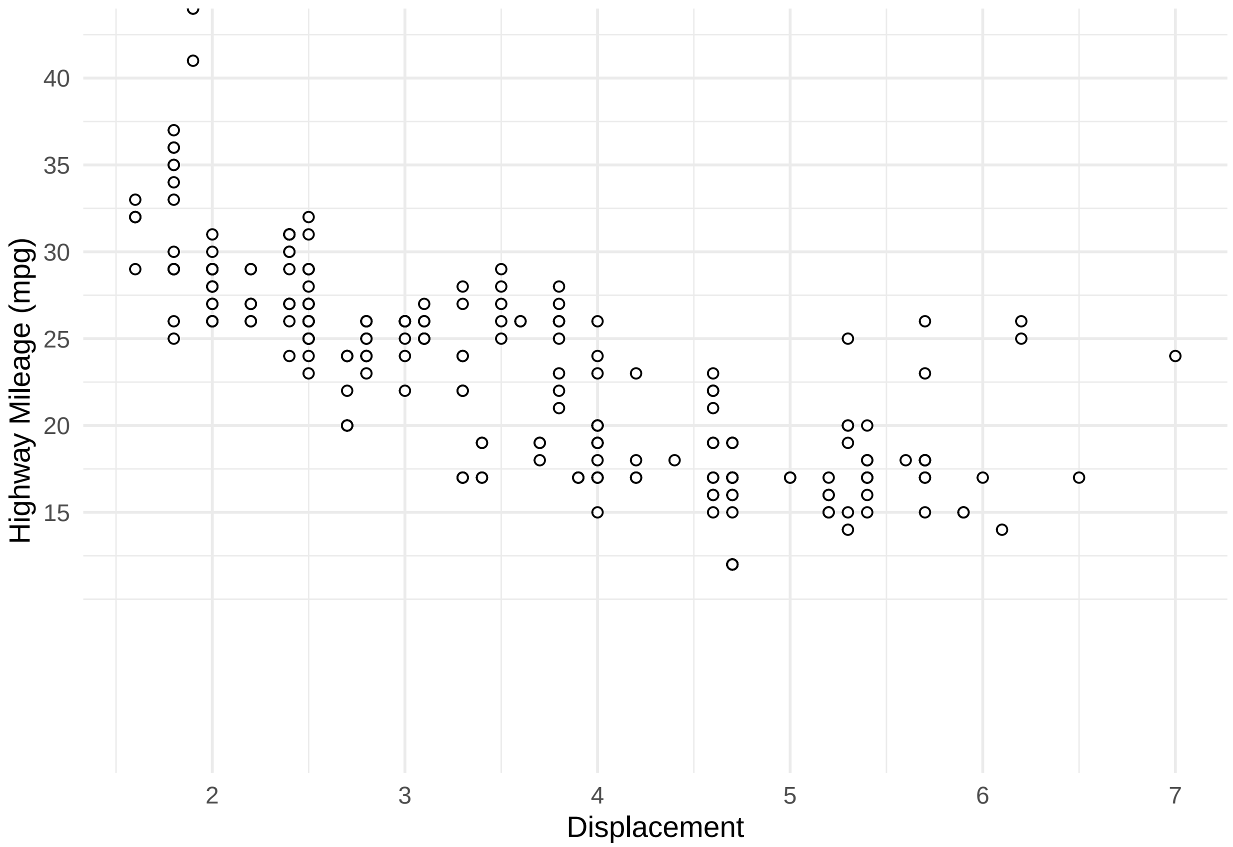
```r
# Histogram with x-axis labeled from 15 to 45 in steps of 5
ggplot(df, aes(x = hwy)) +
  geom_histogram(binwidth = 2, fill = "grey", color = "black") +
  labs(title = "Histogram of Highway Mileage", x = "Highway", y = "Frequency") +
  scale_x_continuous(breaks = seq(15, 45, by = 5)) +
  theme_classic(base_size = 15)
```



```
# Simple Boxplot
ggplot(df, aes(x = hwy)) +
  geom_boxplot(fill = "grey", color = "black", outlier.shape = 21, outlier.fill = "white", outlier.colo
  scale_x_continuous(breaks = seq(15, 45, by = 5), limits = c(10, 45), name = "Highway") +
  theme_minimal()
```

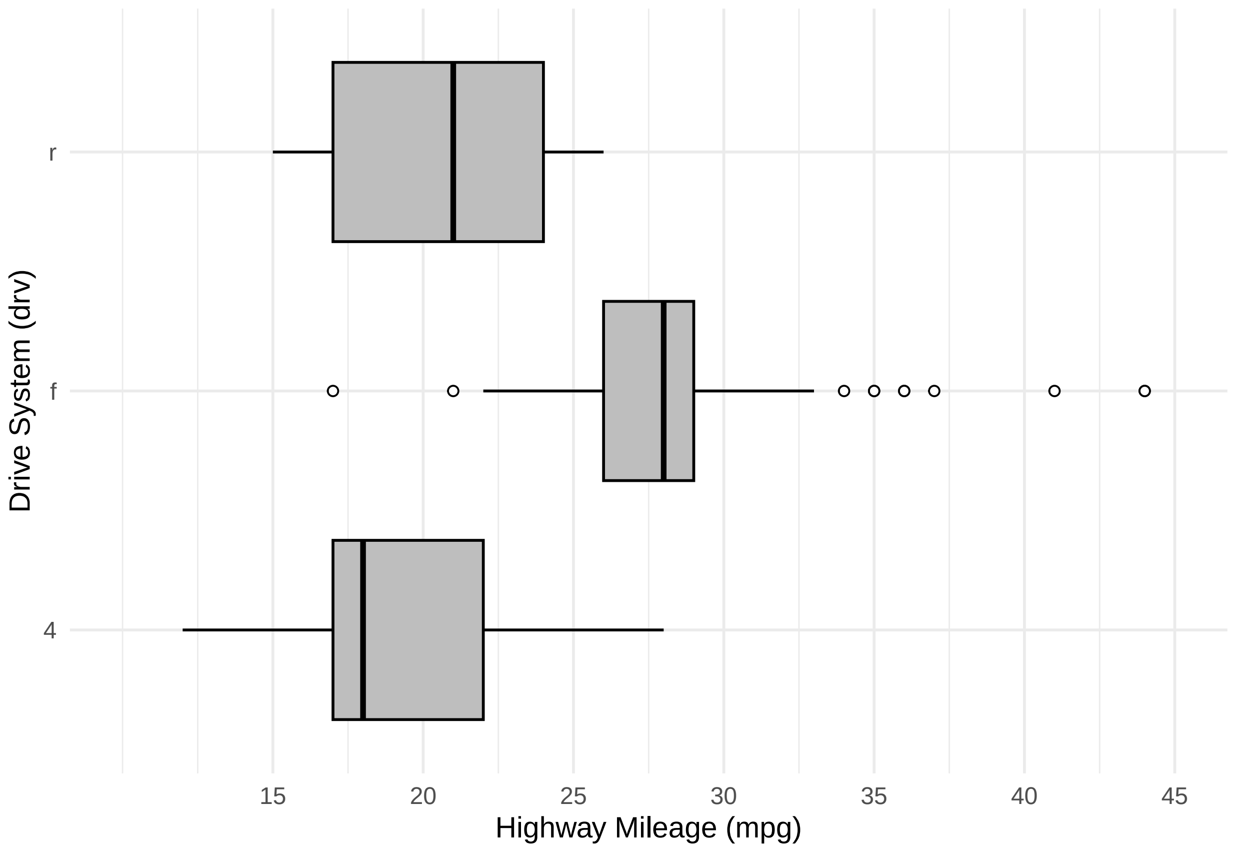


```r
# Scatter plot with adjusted y-axis limits, no grid, and white points with black borders
ggplot(df, aes(x = displ, y = hwy)) +
  geom_point(color = "black", fill = "white", shape = 21) +
  labs(x = "Displacement", y = "Highway Mileage (mpg)") +
  scale_y_continuous(breaks = seq(15, 45, by = 5), limits = c(0, NA), expand = c(0, 0)) +
  theme_minimal()
```

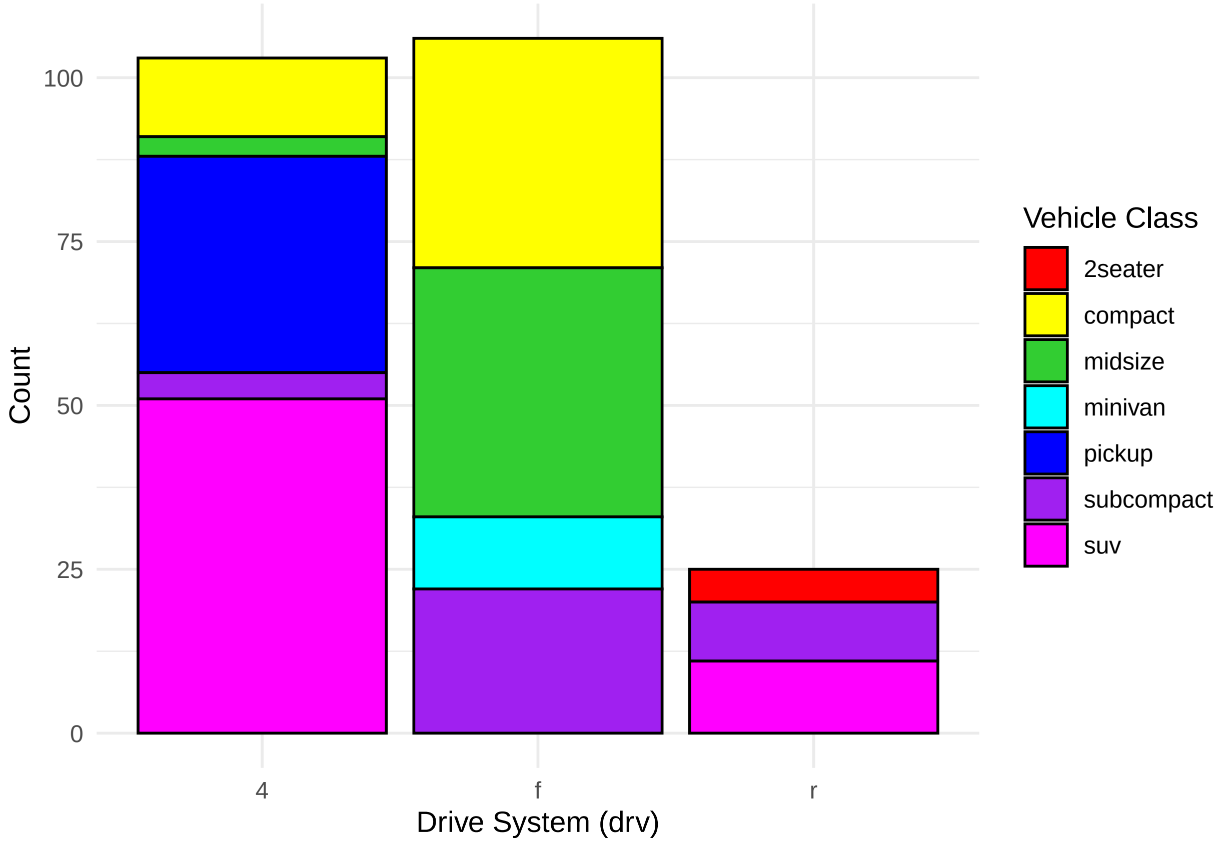


Additional Plots and Analyses

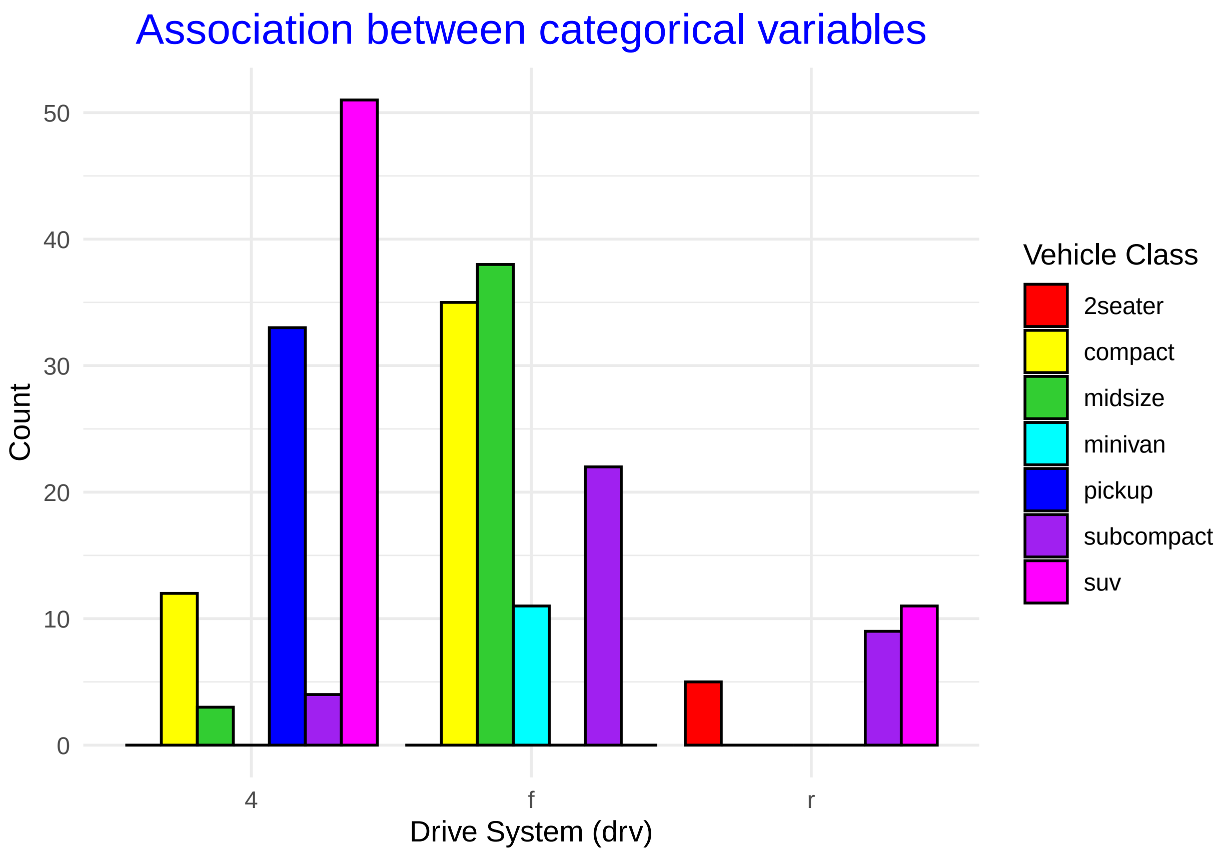
```
# Horizontal boxplot showing the association between highway mileage (hwy) and drive system (drv)
ggplot(df, aes(y = drv, x = hwy)) +
  geom_boxplot(fill = "grey", color = "black", outlier.shape = 21, outlier.fill = "white", outlier.colo
  labs(y = "Drive System (drv)", x = "Highway Mileage (mpg)") +
  scale_x_continuous(breaks = seq(15, 45, by = 5), limits = c(10, 45)) +
  theme_minimal()
```



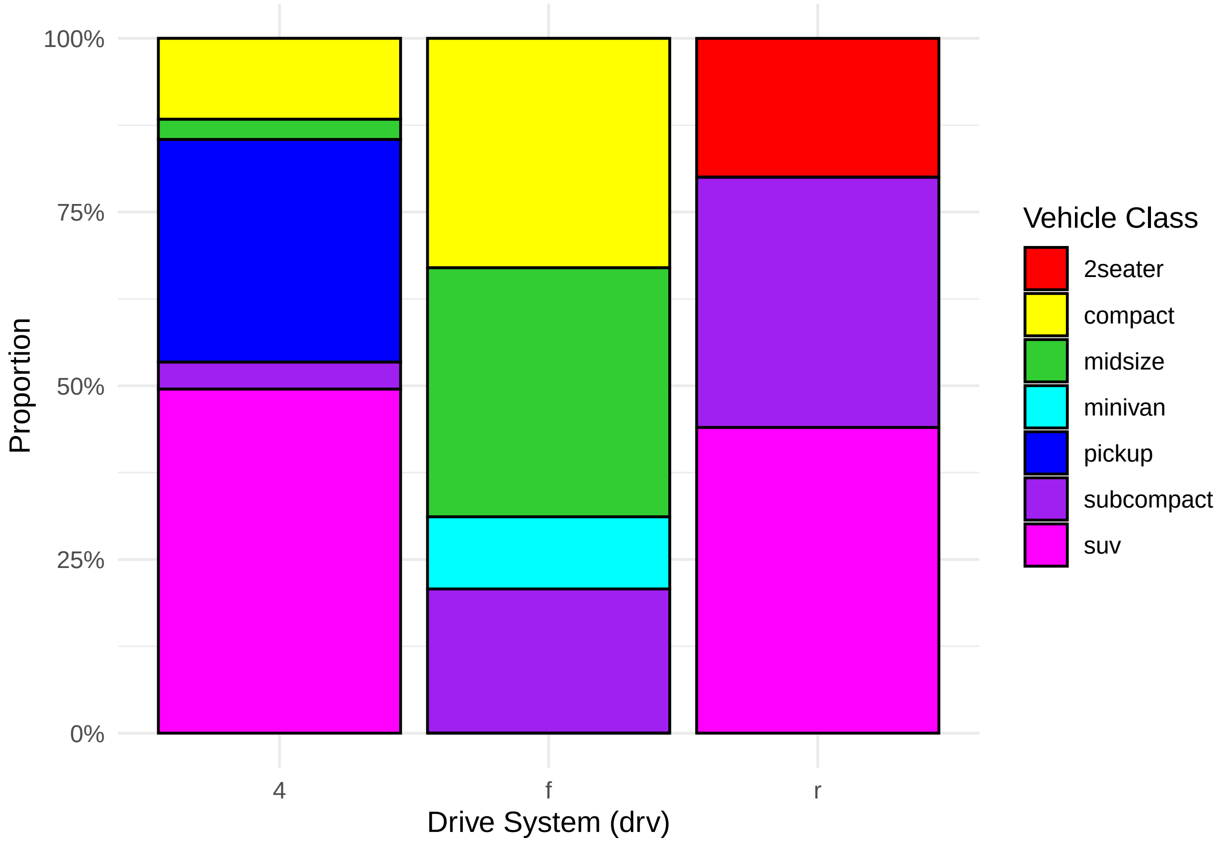
```r
# Stacked bar chart showing the distribution of vehicle classes within each drive type
ggplot(df, aes(x = drv, fill = class)) +
  geom_bar(position = "stack", color = "black") +
  labs(x = "Drive System (drv)", y = "Count", fill = "Vehicle Class") +
  scale_fill_manual(values = c("suv" = "magenta", "subcompact" = "purple", "pickup" = "blue",
                               "minivan" = "cyan", "midsize" = "limegreen", "compact" = "yellow", "2sea
  theme_minimal()
```



```
# Clustered bar chart showing association between drv and class
df_complete <- as.data.frame(table(mpg$drv, mpg$class))
colnames(df_complete) <- c("drv", "class", "n")

ggplot(df_complete, aes(x = drv, y = n, fill = class)) +
  geom_bar(stat = "identity", position = "dodge", color = "black") +
  labs(title = "Association between categorical variables", x = "Drive System (drv)", y = "Count", fill
  scale_fill_manual(values = c("2seater" = "red", "compact" = "yellow", "midsize" = "limegreen",
                               "minivan" = "cyan", "pickup" = "blue", "subcompact" = "purple", "suv" =
  theme_minimal() +
  theme(plot.title = element_text(color = "blue", size = 16, hjust = 0.5))
```



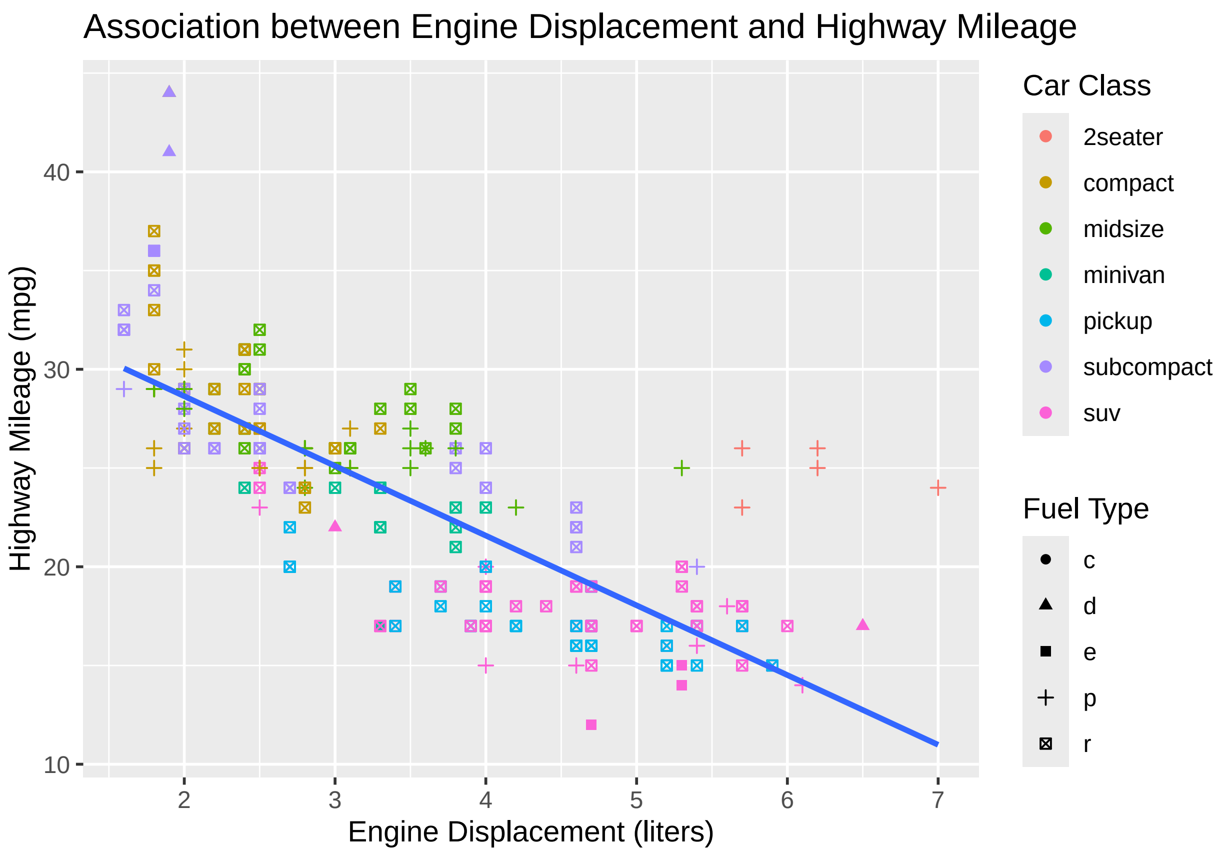
```r
# Stacked bar chart with proportions
df_proportions <- df_complete
df_proportions$proportion <- df_proportions$n / ave(df_proportions$n, df_proportions$drv, FUN = sum)

ggplot(df_proportions, aes(x = drv, y = proportion, fill = class)) +
  geom_bar(stat = "identity", position = "fill", color = "black") +
  labs(x = "Drive System (drv)", y = "Proportion", fill = "Vehicle Class") +
  scale_y_continuous(labels = scales::percent) +
  scale_fill_manual(values = c("2seater" = "red", "compact" = "yellow", "midsize" = "limegreen",
                               "minivan" = "cyan", "pickup" = "blue", "subcompact" = "purple", "suv" =
  theme_minimal()
```



# Task 2: Association between engine displacement and highway mileage

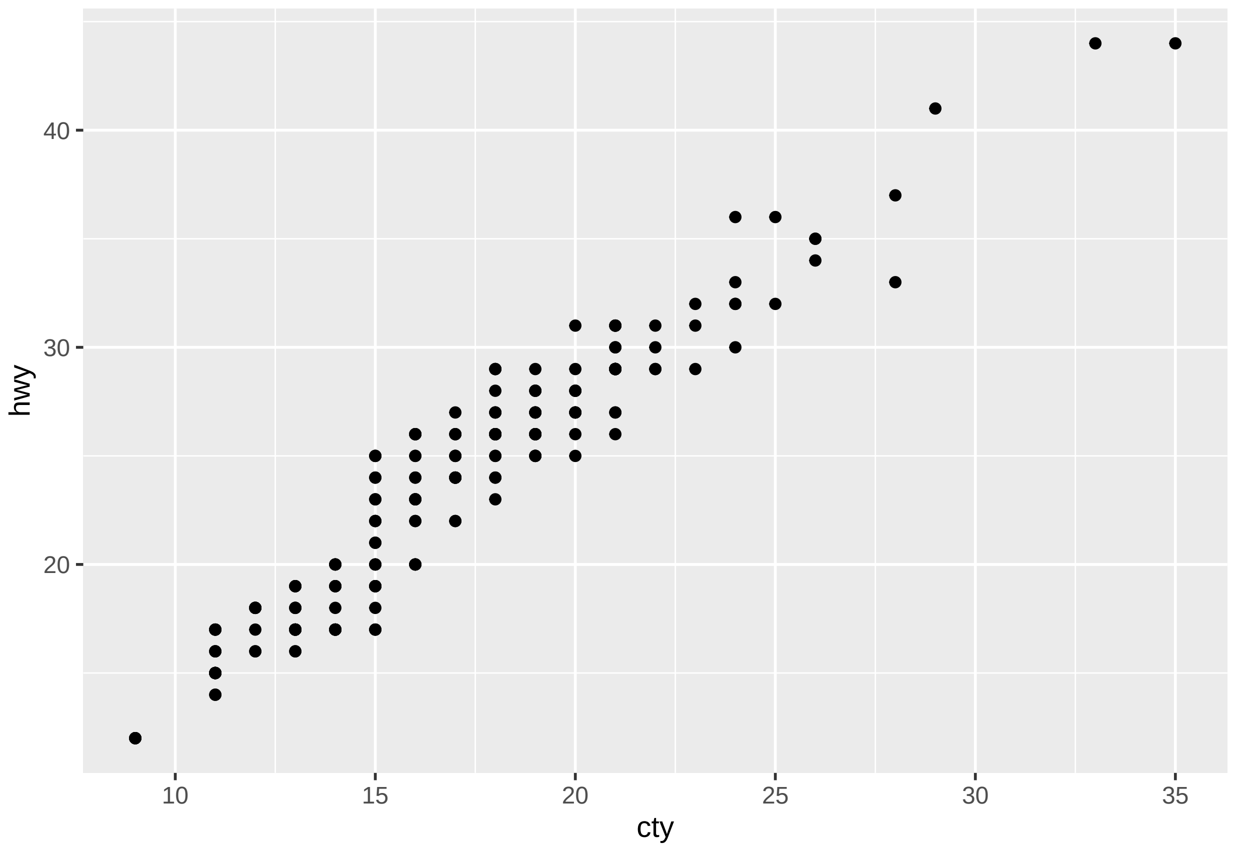
```
# Scatter plot to show the association between engine displacement and highway mileage
ggplot(data = mpg, aes(x = displ, y = hwy)) +
  geom_point(aes(shape = fl, color = class)) +
  geom_smooth(method = "lm", se = F) +
  labs(title = "Association between Engine Displacement and Highway Mileage",
       x = "Engine Displacement (liters)",
       y = "Highway Mileage (mpg)",
       color = "Car Class",
       shape = "Fuel Type")
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

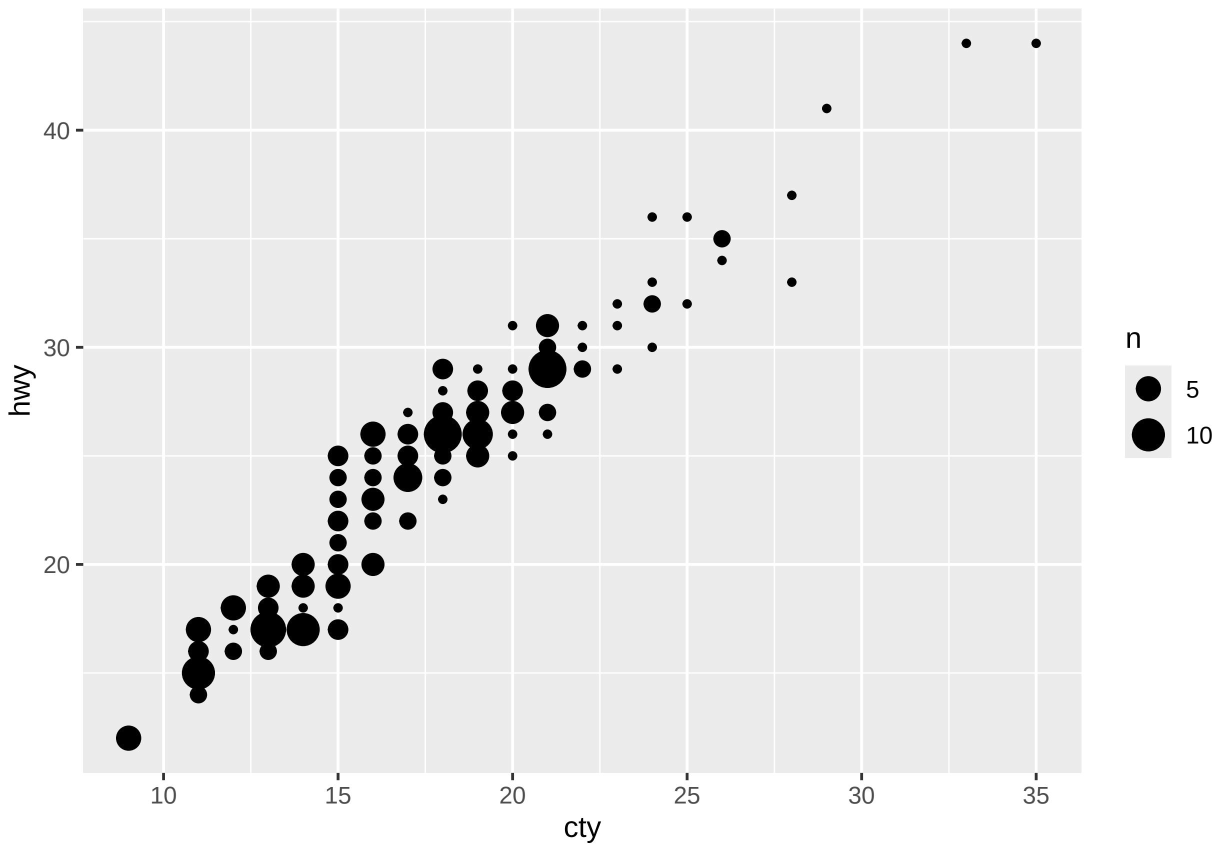


# Task 3: Comparison of geom_point() and geom_count()

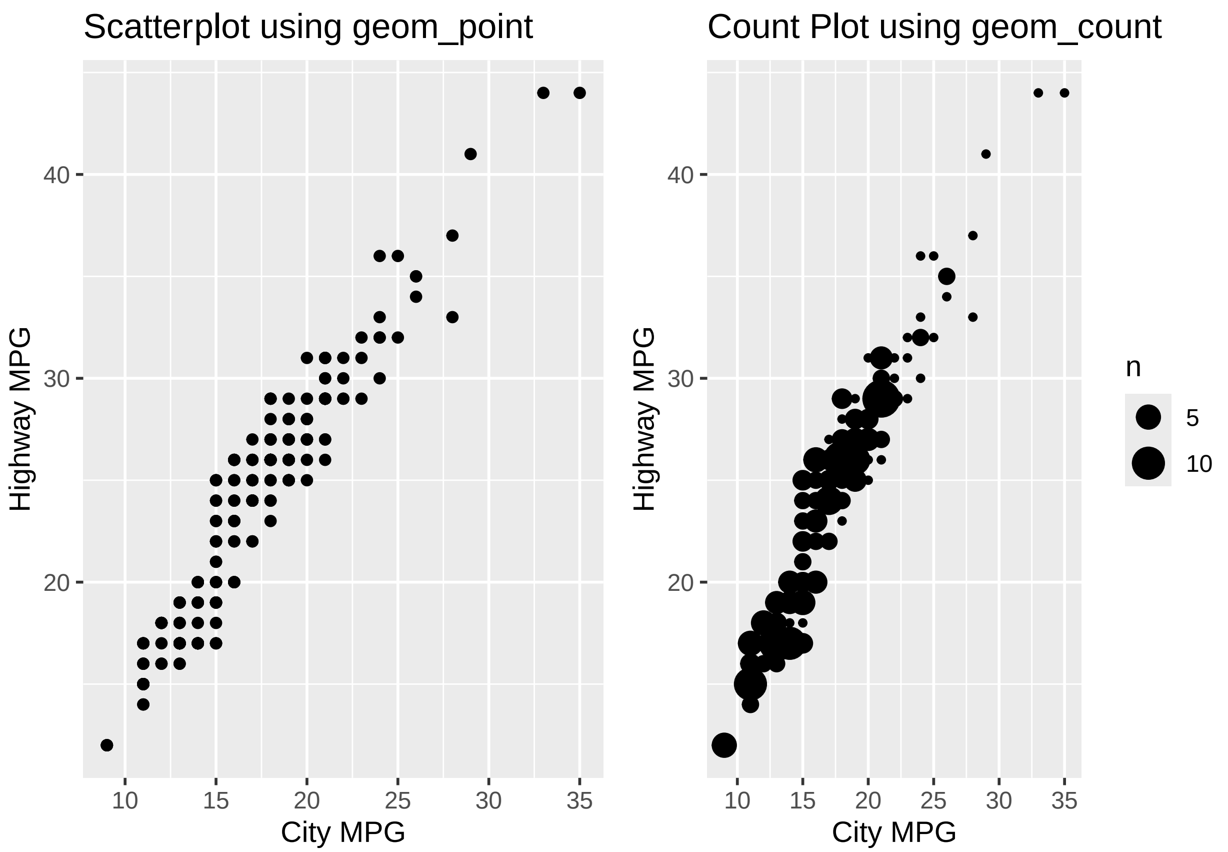
```
# Original geom_poin
ggplot(data = mpg, aes(x = cty, y = hwy)) + geom_point()
```



```
ggplot(data = mpg, aes(x = cty, y = hwy)) + geom_count()
```

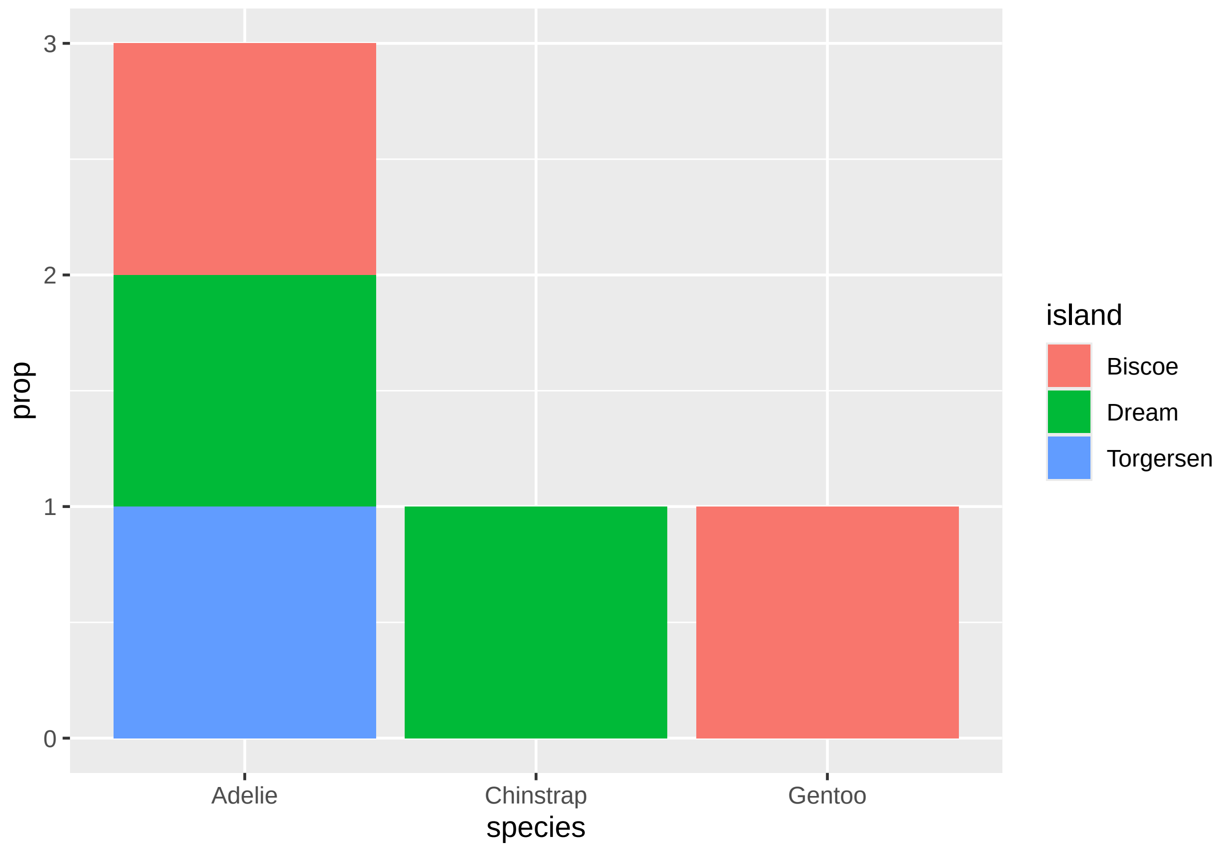


```
# Create geom_point plot
point_plot <- ggplot(data = mpg, aes(x = cty, y = hwy)) +
              geom_point() +
              labs(title = "Scatterplot using geom_point", x = "City MPG", y = "Highway MPG")

# Create geom_count plot
count_plot <- ggplot(data = mpg, aes(x = cty, y = hwy)) +
              geom_count() +
              labs(title = "Count Plot using geom_count", x = "City MPG", y = "Highway MPG")

# Display the plots side by side
grid.arrange(point_plot, count_plot, ncol = 2)
```

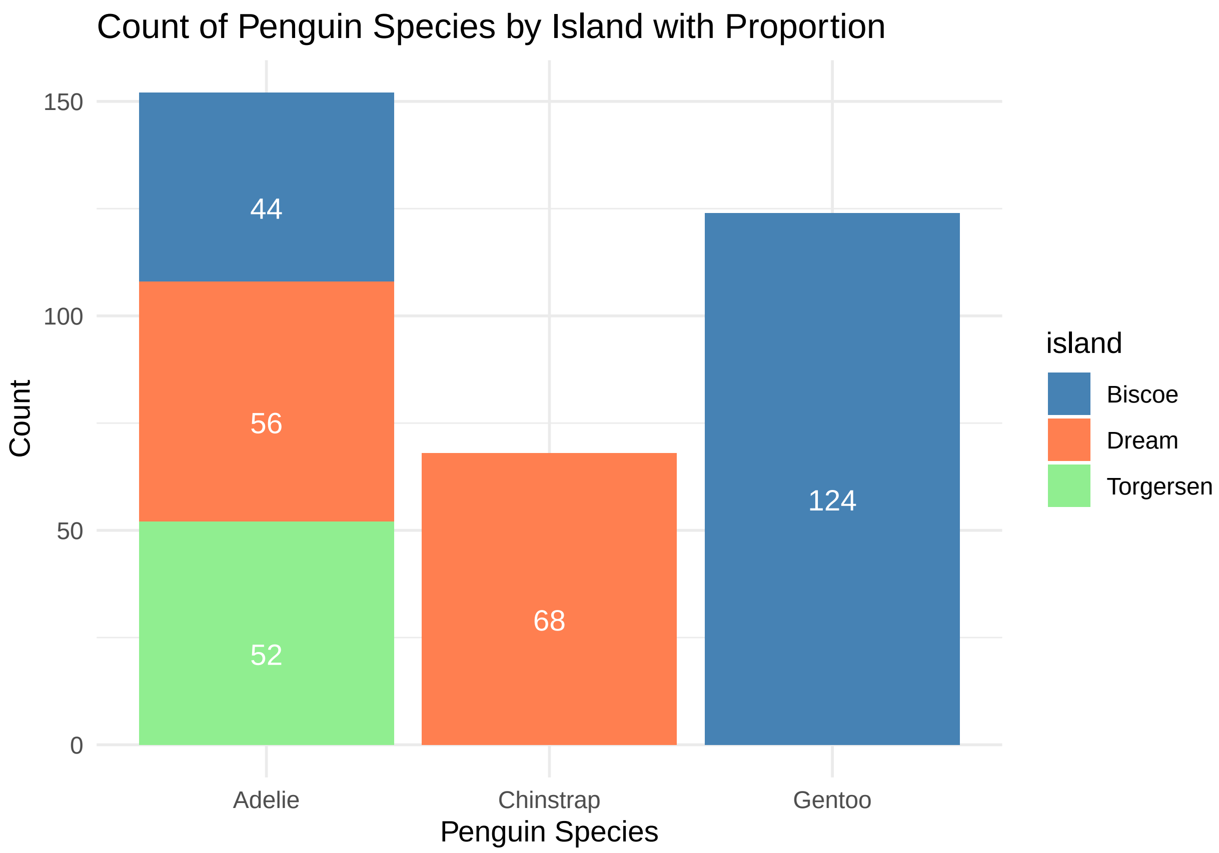


# Task 4: Penguins

```
# Load the penguins dataset
data(penguins)

# Original (copy of the homework)
ggplot(data = penguins, aes(fill = island, x = species)) +
geom_bar(aes(y = after_stat(prop)))
```



```
# Problems with the original plot
# In the original plot, you can only see which penguin species are present on each island. For example,


# Improved version with absolute counts displayed over proportionally filled bars
p <- ggplot(data = penguins, aes(x = species, fill = island)) +
  geom_bar(position = "stack") +
  geom_text(stat = "count",
            aes(label = after_stat(count)),
            position = position_stack(vjust = 0.5),
            color = "white",
            vjust = 1.5) +
  labs(title = "Count of Penguin Species by Island with Proportion",
       x = "Penguin Species",
       y = "Count") +
  scale_fill_manual(values = c("Biscoe" = "steelblue", "Dream" = "coral", "Torgersen" = "lightgreen"))
  theme_minimal()

# Display the plot
p
```



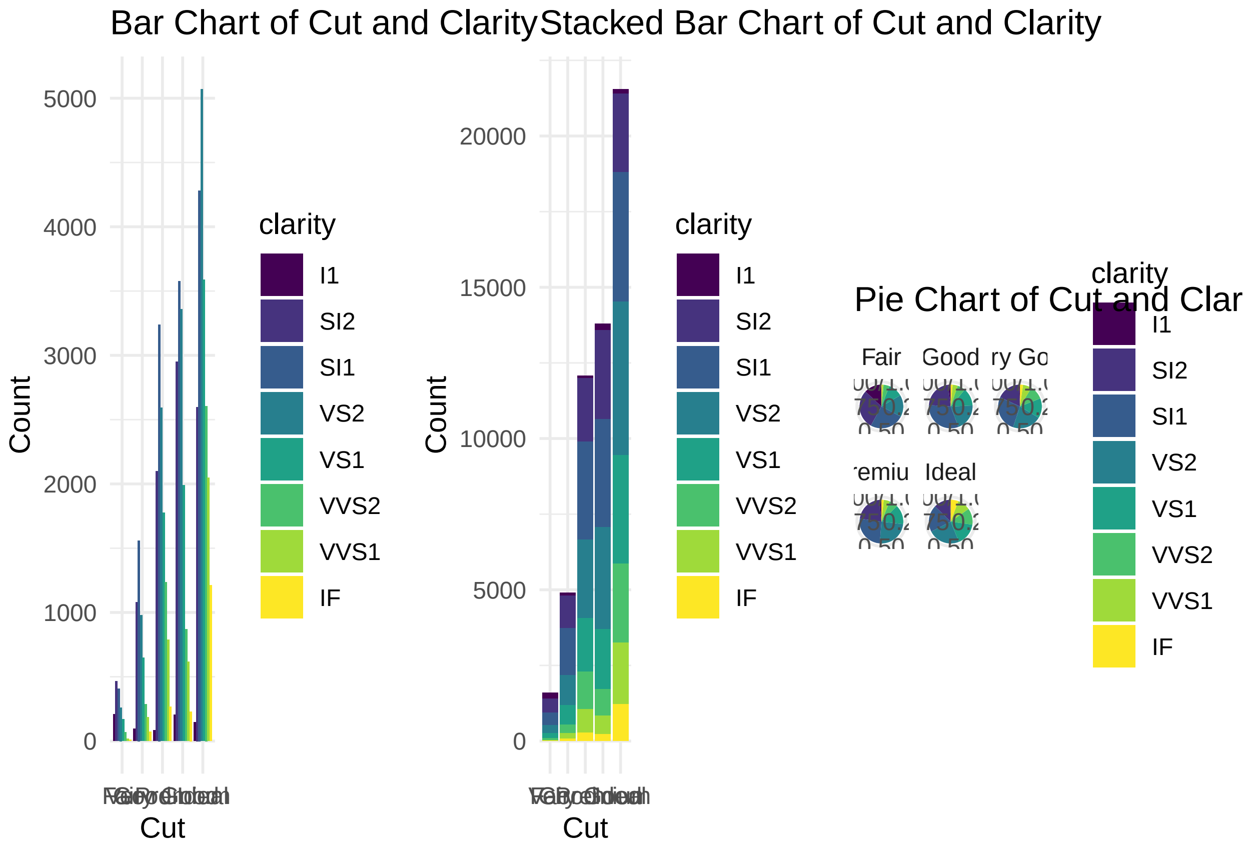
# Task 5

```
# Load the diamonds dataset
data(diamonds)

# Basic bar chart
bar_plot <- ggplot(diamonds, aes(x = cut, fill = clarity)) +
            geom_bar(position = "dodge") +
            labs(title = "Bar Chart of Cut and Clarity", x = "Cut", y = "Count") +
            theme_minimal()
```

```
# Stacked bar chart
stacked_bar_plot <- ggplot(diamonds, aes(x = cut, fill = clarity)) +
                    geom_bar(position = "stack") +
                    labs(title = "Stacked Bar Chart of Cut and Clarity", x = "Cut", y = "Count") +
                    theme_minimal()
```

```
# Pie chart
pie_chart <- ggplot(diamonds, aes(x = "", fill = clarity)) +
             geom_bar(width = 1, position = "fill") +
             coord_polar("y") +
             facet_wrap(~cut) +
             labs(title = "Pie Chart of Cut and Clarity") +
             theme_minimal() +
             theme(axis.title.x = element_blank(), axis.title.y = element_blank())
```

```r
# Display the charts side by side
grid.arrange(bar_plot, stacked_bar_plot, pie_chart, ncol = 3)
```



# Which Slides Did We Use for Each Task

- **Creating R Project**: Referenced *EMPR_03b_Projects_Reports_AS2024.pdf*.
- **Task 2**:
- For Task 2, we primarily referenced EMPR_03_Visualization1_AS2024.pdf, which covers most aspects of scatter plots. Pages 4, 7, and 14 were especially helpful -for our work.
- **Task 3**:
- For Task 3, we primarily referenced EMPR_03_Visualization1_AS2024.pdf, which covers most aspects of scatter plots. Pages 2, 4, and 5 were especially helpful -for our work.
- **Task 4**:
- For Task 4, we primarily referenced EMPR_04_Visualization2_AS2024.pdf, page 8 ("Add counts to bars: geom_text() or geom_label()"), and adapted the code to - -suit our requirements
- **Task 5**:
- For Task 5, we primarily referenced EMPR_04_Visualization2_AS2024.pdf; Pages 3 and 10 provided guidance on creating bar charts using geom_bar() and explained the use of the position argument for arranging bars (defaulting to "stack" for stacked bar charts, with "dodge" used for grouped bar charts). Page 12 introduced pie charts and explained how to create them using coord_polar().Page 13 demonstrated examples of applying coord_polar() to geom_bar() to create pie charts, similar to the approach used in our code.

#Workload #We sat down at the beginning and divided up the tasks. The first thing we did was set up a git repository so that we could easily work together and always see what the other person had done. We organised the tasks so that Fabian did tasks 1 and 2 and Samuel did tasks 3-5. Afterwards we had a short meeting and discussion about the status of the work. We actually got on quite well. Even though we hadn't finished some things yet. We then agreed that Fabian would check and correct Samuel's tasks and the other way round.

#verbesserung task3? zusammen besprechen

Task 3: Comparison of geom_point() and geom_count()

Scatter plot using geom_point

point_plot <- ggplot(data = mpg, aes(x = cty, y = hwy)) + geom_point(alpha = 0.6) + # Add slight transparency for overlapping points labs(title = "Scatterplot using geom_point", x = "City MPG", y = "Highway MPG") + theme_minimal()

Count plot using geom_count

count_plot <- ggplot(data = mpg, aes(x = cty, y = hwy)) + geom_count(color = "blue", alpha = 0.6) + # Color to enhance density visibility labs(title = "Count Plot using geom_count", x = "City MPG", y = "Highway MPG") + theme_minimal()

Display plots side by side

grid.arrange(point_plot, count_plot, ncol = 2)

#explanation task3

#For Task 3, we use geom_point() and geom_count() to explore the relationship between cty (city MPG) and hwy (highway MPG) in the mpg dataset. In the scatter plot with geom_point() (as suggested in the slides on visualizing distributions), each point represents an observation, which can obscure dense areas if points overlap. Adding slight transparency (alpha) mitigates this and reveals overlapping data points. In contrast, geom_count() changes the size of each point based on its count, providing a clear indication of where data points are densest, a recommendation seen in the slides for visual clarity when values overlap. Overall, geom_point() is ideal for datasets with low overlap, while geom_count() effectively highlights density in datasets with repeated values. These enhancements meet the general assignment criteria for readability and clarity in data presentation.

#verbesserung task5? zusammen besprechen

Load the diamonds dataset

data(diamonds)

Basic bar chart - Grouped by clarity with separate bars for each category

bar_plot <- ggplot(diamonds, aes(x = cut, fill = clarity)) + geom_bar(position = “dodge”) + # position ‘dodge’ for grouped bars labs(title = “Bar Chart of Cut by Clarity (Grouped)”, x = “Diamond Cut”, y = “Count”) + theme_minimal() + theme(legend.position = “bottom”, legend.title = element_blank())

Stacked bar chart - Stacked by clarity for each category of cut

stacked_bar_plot <- ggplot(diamonds, aes(x = cut, fill = clarity)) + geom_bar(position = “stack”) + # position ‘stack’ for stacked bars labs(title = “Stacked Bar Chart of Cut by Clarity”, x = “Diamond Cut”, y = “Count”) + theme_minimal() + theme(legend.position = “bottom”, legend.title = element_blank())

Pie chart - Displaying proportions of clarity within each cut category

pie_chart <- ggplot(diamonds, aes(x = “ “, fill = clarity)) + geom_bar(width = 1, position =”fill”) + # use ‘fill’ to normalize each bar coord_polar(“y”) + # polar coordinates to create a pie chart facet_wrap(~cut) + # facet by ‘cut’ to show one pie chart per cut labs(title = “Pie Chart of Cut by Clarity (Faceted)”, x = NULL, y = NULL) + theme_minimal() + theme(axis.title.x = element_blank(), axis.title.y = element_blank(), axis.text = element_blank(), legend.position = “bottom”, legend.title = element_blank())

Display the charts side by side

grid.arrange(bar_plot, stacked_bar_plot, pie_chart, ncol = 3)

#comparison task 5 #For this task, we created three visualizations to explore the distribution of clarity within each cut category in the diamonds dataset. The grouped bar chart, referencing slide 10, shows clarity levels side-by-side within each cut, making comparisons straightforward. The stacked bar chart, also inspired by slide 10, stacks clarity levels within each cut, emphasizing relative contributions to the total counts. Finally, the faceted pie chart, which uses guidance from slides 12 and 13 on polar coordinates, displays the proportional breakdown of clarity within each cut. While the grouped bar chart is best for clear comparisons, the stacked bar and pie charts provide insights into the relative proportions, each with their own visual strengths.